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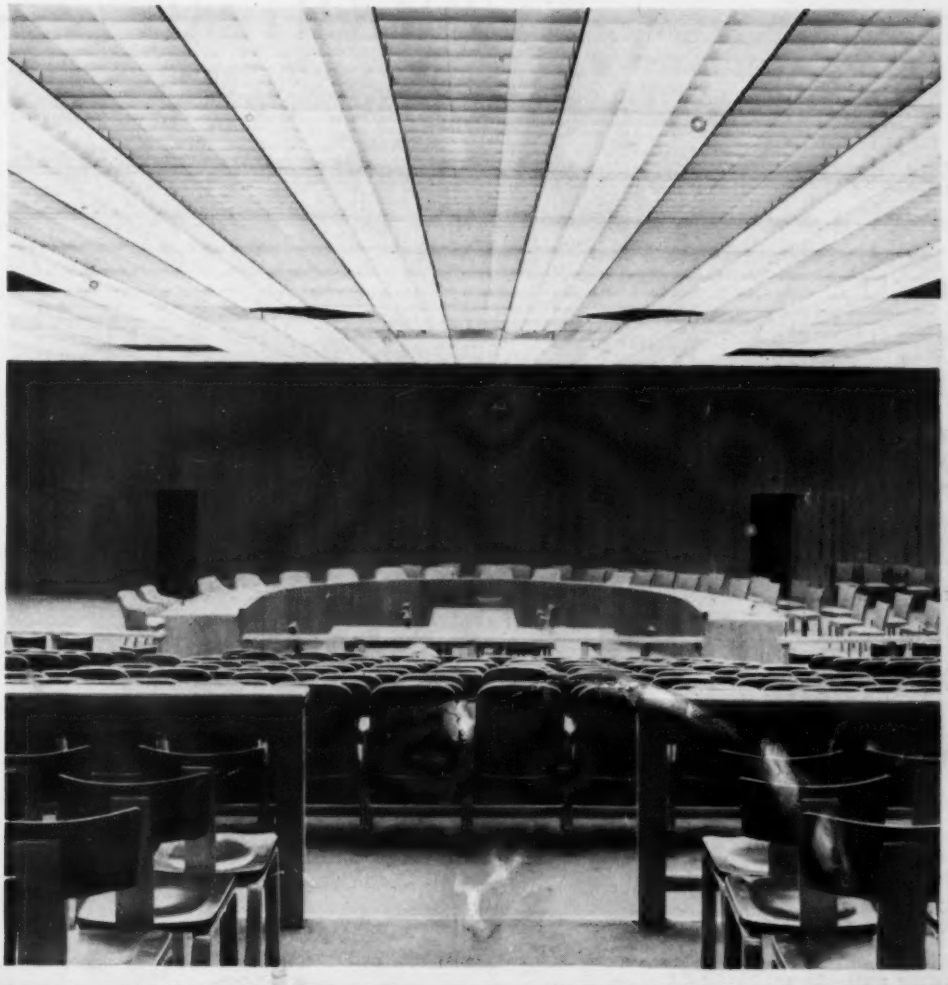

OCTOBER 26, 1946

Induction Heating at Sixty Cycles • Automatic Assembly of Watthour Meters

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Ultra-Modern Lighting for United Nations

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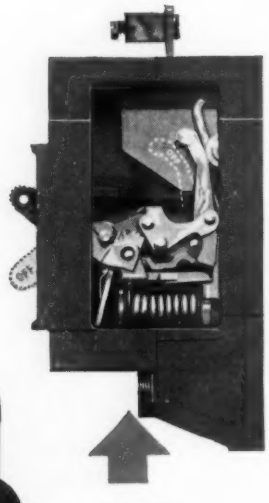
IMPORTANT ANNOUNCEMENT

NOW *in production*—Murray MAGNETIC CIRCUIT BREAKERS

IN NEW APPLICATIONS



THESE much-wanted, new applications are shown below. The heart of each is the Murray MAGNETIC Circuit Breaker—magnetic, because, by means of magnetism alone and without thermal action of any kind, it provides absolutely instantaneous shut-off of current in the event of a short circuit and delayed interruption in the case of overloads. These compact, underwriter-approved Murray Magnetic Circuit Breakers are ready for shipment NOW. Write or 'phone your nearest jobber for all the facts, or ask us direct. Metropolitan Device Corporation, Brooklyn 16, New York.

ABOVE

The use of a magnetic tripping mechanism and an efficient magnetic blow-out provides an instantaneous circuit interruption in the event of a short circuit. A precision time-delay device accommodates the brief overloads normally encountered, such as motor-starting currents or the high initial current flow through tungsten lamps. The characteristics of the Murray Magnetic Circuit Breaker are not affected by above-normal temperatures ordinarily found in service equipment.

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BROOKLYN 16, NEW YORK

Electrical World

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October 26, 1946 — Vol. 126, No. 17

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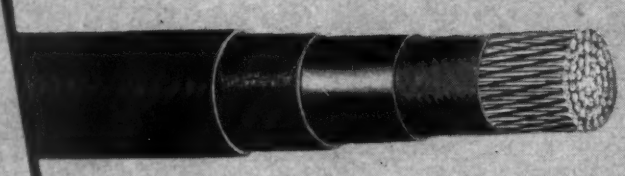

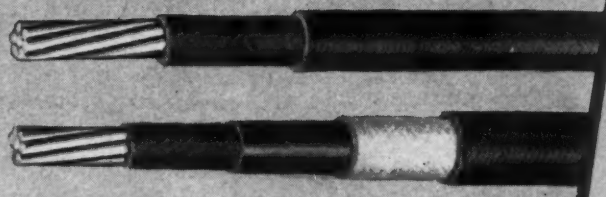

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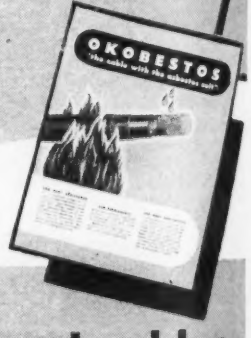


OKONITE OKONITE SINCE 1878 **insulated wires and cables**

4750

Electrical World

OCTOBER 26, 1946

National Farm Electrification Conference

THE RECORD shows that the American farmer is prosperous today as never before. That as a tenant farmer he is decreasing in number and as an owner farmer, increasing. That he is paying off his mortgage. That he has cash and liquid assets in plenty to pay for the manufactured goods he impatiently waits to buy.

This happy condition of the farmer gives special emphasis and timeliness to the first annual meeting of the National Farm Electrification Conference to be held in Chicago the 7th and 8th of next month. The program for the meeting indicates that those who set it up worked in full appreciation of the present exceptional opportunity for promotion of intensive application of electricity to agricultural production.

The program makers realized, evidently, that the commercial interest of suppliers of farm electric equipment and devices, and of the energy to operate them, is not of itself enough to meet that opportunity adequately. They saw the purpose of the Conference in larger scope and included in its program attention to the problems of education, of training and of public understanding for which solutions must be found before the full value of electricity in farm production operations can even be approached.

As is disclosed by the program, there is implicit in the purpose of the Conference an awareness that the time is past for farm electrification to be thought of and worked on as a thing by itself, that its importance in a larger picture transcends the specific concerns of the manufacturing and utility groups among whom the idea of the Conference originated.

Plainly it was seen that farm electrification is more than taking the drudgery out of farm life—more than bringing greater convenience and comfort to the farm home—more than making easier the chores around the place—more than water pumps, feed grinders, refrigerators, ranges, radios, lights—more than any one or all of its multifarious uses and values. It was seen that farm electrification defies arithmetic; its whole is greater than the sum of its parts.

Farm electrification is more than the aggregate of its components because it is a major factor in a bigger thing. This is the production revolution in American agriculture, that, speeded up by the war, is ready for further acceleration by reason of present farm prosperity.

Already the ratio of land to equipment and facilities in farm investment has declined from the historical ten or more to one, to three or even two to one. Already a trend to larger and fewer farms is observable as mechanical equipment comes into larger use. Already modern production methods have gained a foothold in farming operations. But it is yet only a foothold. It will have to be expanded and consolidated until farming actually becomes the "agricultural industry" it is now rather inaccurately termed.

Because electricity is essential to the production revolution now going on in American agriculture, the National Farm Electrification Conference should be supported wholeheartedly and unreservedly by every branch of the electrical industry. The enthusiasm with which the Conference was organized and carried up to its first meeting proves that it now has such support. It must not weaken, but grow stronger to build up the Conference as a continuing force for agricultural, thus national, progress.

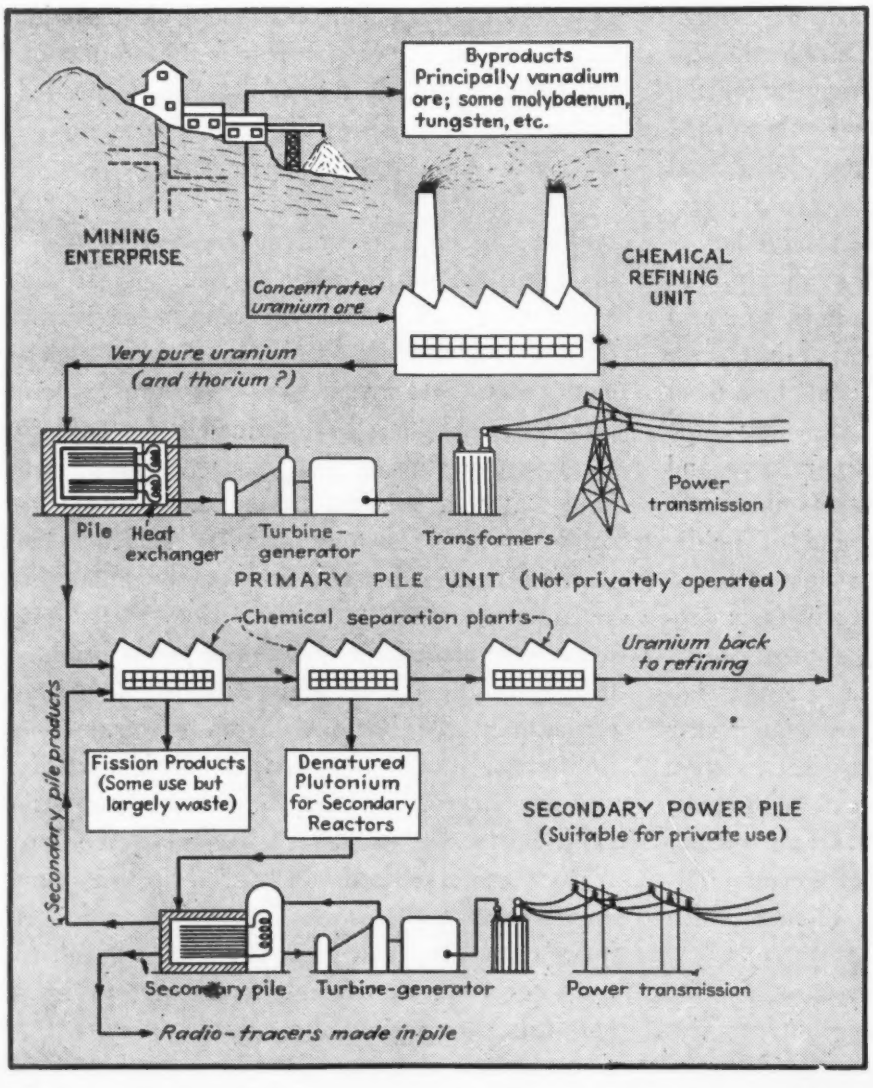
Atomic Power Production

Sources of uranium, its separation and refinement, probable costs per pound of the "fuel"—Objectives of Daniels pile project at Oak Ridge—Technique of mechanical conversion in steam or gas turbine

FOR AN industrial scientist the problem of harnessing atomic energy can be stated as follows: *It is desired to transform random high-energy atomic and molecular motion into a form that is readily transported and utilized with as great an efficiency as possible.* This differs from the thermal systems to which heat engines have been applied only in that the high energies involved may be a million-fold greater.

Uranium is not a rare element. Its abundance in the earth's crust is greater than that of silver, antimony, and mercury combined, metals which have been extensively mined and are now key components in our industry. Thorium is still more abundant than uranium.

This relative abundance is not closely related to availability however. The uranium is locked up to the greatest extent in igneous rocks, among which it is sometimes found concentrated to a minor degree in pegmatites (coarse granites occurring in dikes and veins). Unlike many of the elements, uranium was not concentrated into rich ore bodies. Few of the known primary deposits contain uranium in sufficient concentration to permit commercial exploitation. The richer and more utilizable deposits have been formed through erosion of large volumes of igneous rocks and subsequent concentration by surface waters. These concentrations by natural means must be more than 1,000-fold before 5 to 20 pounds of uranium per ton of ore can be obtained, a range which would appear to be the lowest limit that is economical at present. To make things more difficult, much of the uranium is intimately combined with other elements which are chemically and crystallographically similar (vanadium, etc.) which adds to the effort needed to extract it from the ores. The value of vanadium and other byproduct metals is usually able to provide only a partial recompense for the extra effort involved.



STAGES in transformation of atomic energy into electrical energy

Workable Deposits Scarce

The known workable deposits of uranium are scarce. This is primarily because the ores had no value until 1940 and were not sought by the prospectors. Recently there has been a flurry of reports relating to the discovery of new deposits in all

Is Economically Promising . . . I

Future of Atomic Energy in Industrial Application

ONCE it is shown that uranium and its companion elements can make considerable contributions to the efficient production of economic goods, then the efforts now being initiated to control this new force can operate along more positive lines. The emphasis can gradually change from that of preventing atomic warfare to one of promoting international development of industry and agriculture. It is desirable to proceed as rapidly as possible to make atomic energy socially useful. In particular the problem of power from atomic energy needs to be investigated from every possible approach so that the principal difficulties may be foreseen and work started towards their solution.

The study here reported was prepared as a project of the Carnegie Endowment Committee on Atomic Energy, represented at the University of California by Prof. J. B. Condliffe, in cooperation with the Northern California Association of Scientists. The paper is intended primarily to be an analysis of the information available at present put into form deemed usable by research workers and administrators in the more non-technical fields. Many members of the group both at the University and in various industries have been very helpful in the preparation and the criticism of the manuscript.—Editors.

parts of the world. However, from the existing knowledge of the origin of uranium deposits which is believed to be quite complete, new discoveries can be expected to diminish in size and number. Thus a generation or so hence we shall be facing the problems of developing medium to low grade ores, altogether not a catastrophic eventuality because we are considering here metals which have an intrinsic worth greater than the selling price of gold.

The more acidic light-colored igneous rocks such as the granites and the rhyolites, have been shown to contain 10 to 20 grams of fissionable elements per ton (20 to 25 percent of which is uranium, the remainder thorium) while the more basic and generally older and darker igneous rocks such as basalt usually have only 3 to 8 grams per ton. This means that the world has now a huge reserve of fuel for power production. If 10 grams of the fissionable materials in a ton of granite were extracted and "reacted" the resultant power would be equivalent to more than 40 tons of coal. Since granite is one of the most common rocks on the face of the earth the supply of "low grade ore" seems to be relatively limitless.

Cost to Mine and Refine

At present it is estimated that the mining costs for uranium should be in the neighborhood of $2 to $5 per pound of metal in order to be economic and competitive with present sources. Since utilization in a pile requires scrupulous purity it is probable that the costs of additional refining may raise the total expense as charged to the power producing plant to around $5 to $10 per pound. These costs are based on the exploitation of presently known ore bodies, which in general are very limited in extent, so that the costs of fissionable materials are likely to go up gradually in the future. Allowing expenses of several dollars per gram it should not be difficult to work out methods for extracting fissionable material from granites or other low grade large volume sources. As will be seen later, a cost of several dollars per gram would barely affect the cost of power if one takes into account the fact that practically all of the fissionable materials introduced into a power pile probably could eventually be transformed into energy.

The sensible way to go about the utilization of uranium resources would be to set up a coordinated world-wide geological survey. This agency would plot out the most favorable areas for prospecting and investigating them in the order of their promise. Such procedure would postpone the day that would require the development of means to recover uranium from low grade ores to some time perhaps 20 to 50 years hence. This should be a sufficient period for the normal process development of new ore concentrating and refining techniques. One of the principal difficulties of large mines treating low grade ores is power supply, an item which is likely to be high in cost due to the isolated character of many such deposits, but even this might be handled simply by the installation of atomic power plants.

Thorium Has Potentialities

It can be concluded then that the new resources of energy-yielding mineral deposits are sufficient to carry the human race through many centuries. No major difficulties are expected in the conversion of ore to refined metal.

At present only uranium and plutonium piles can operate continuously in the production of power. It is indicated in the present stage of theoretical development that thorium,

by a roundabout process, may be used as a primary fuel in conjunction with uranium and plutonium. The basic research on thorium however has not been released so that it is impossible to predict at present whether thorium fission can be used to advantage. It has been shown recently that 3 to 4 times as much thorium exists in the earth's crust as uranium and that as a fuel it is likely to remain cheap for a longer period of time. It is difficult to say whether any fundamental data on the use of thorium needs to be obtained, but if such a situation exists it would certainly deserve the highest priority.

In summary then an analysis of the theoretical approach to power production leads to the following conclusions:

1. All possible encouragement must be given to the development of a fundamental theory of atomic nuclei;

2. The possibility of waste of capital due to premature obsolescence caused by revolutionary advances in the science of nuclear physics is reduced once such a theory exists.

3. Due to its much greater abundance, the way should be cleared toward the utilization of thorium in power piles.

The Engineer's Approach

Materials and techniques used in present piles work well enough but in most cases they cost too much, and in many instances they are still highly inefficient. The improvement of design and construction is a lengthy and arduous task, one that should be embarked upon as soon as possible with a highly coordinated staff.

The War Department is carrying out a part of this work. The sum of $2,500,000 has been authorized for the design and construction of the Daniels Pile, which is to be the world's first high temperature uranium pile. This project is reported to be primarily a means of testing out certain ideas of the general pile behavior at high temperatures and is not necessarily intended to be any pilot plant for future producing units. Engineers at Oak Ridge believe that the Daniels Pile will be in operation some time in the spring of 1947 and produce some power by 1948.

Design engineers have taken the available published information and tried to estimate very roughly the cost of installing high energy reactors as the thermal units in power plants of specified sizes. The large size (100,000 kw.) would provide sufficient power for a highly industrialized area including several hundred thousand people whereas the small size (20,000 kw.) is sufficient for isolated operations.

The large size was envisaged to consist first of a thick shell of concrete and special insulating materials perhaps 30 to 50 ft. in diameter sunk in the ground. Then on the inside of this shell would be found a "tamper" or "reflector," which may be made of beryllium or some other material which does not lead to the loss of neutrons but causes a rapid reduction in their velocity. Next to the "reflector" possibly would be found a layer of chemicals so chosen that they would react with the stray neutrons from the reaction and form such radio-tracers as may be desired. In the interior, the pile itself, would be a mass of plutonium which is suitably protected from the heat it is expected to evolve, highly purified moderator which is intended to reduce the velocity of the neutrons produced by fission, and a heat exchange medium consisting of liquefied metal. Preliminary calculations seem to indicate that the means employed in transferring the heat from the plutonium to the steam which would actuate a turbine will determine the dimensions of the interior.

Two Alternatives Available

The design engineer at present appears to have two alternatives, (1) pump around huge quantities of hot molten metal, or (2) vaporize and condense a suitable metallic liquid. Both systems seem to have their difficulties but scientists who have complete access to the present knowledge of pile operation are confident that these difficulties can be resolved in a few years. In addition machinery must be installed for loading and unloading of the plutonium and perhaps also for the occasional replacement of other parts of the pile.

Besides the reactor a considerable amount of accessory equipment must be present. A small chemical plant, operated by remote control, must dissolve the "burned out" slugs of plutonium and separate it by chemical means from the fission products. The unreacted plutonium then can be returned to the pile. The useful fission products would be separated there and the remainder disposed of. Waste disposal was conceived as consisting of deep wells similar to natural gas wells driven to a stratum where a suitable reservoir could be eroded out; it could also be a pipeline to the bottom of the ocean, or some other strategem of equivalent cost. Other plant facilities would probably be necessary to further process and put into distributable form the tracers that would be obtained but it is assumed that all such installations would be paid for by the sales of tracers, and would not be involved in the economics of power production.

Steam or Gas Turbine

The turbine then would be operated by steam, or perhaps by air, which was heated by being passed over coils containing the heat exchange fluid brought from the pile. In this manner it is hoped to minimize the problem of getting highly radioactive material inside the turbine, which would tend to preclude any sort of repair and maintenance work. The turbine should be operated at more than 1,000 deg. F. if the highest efficiency is to be obtained. It is interesting to note that a turbine operated with plutonium fuel in such a manner as described would have a considerable advantage in thermal efficiency, that is, the ability to transform thermal energy into electrical energy. Since no large volumes of gases are formed as a result of "combustion" in a pile, and losses due to radiation and convection are infinitesimal, it is obvious that practically no heat goes out of the chimney. Therefore an efficient plant should easily transform 40 percent of the calories evolved into kilowatt-hours.

The remainder of the downstream side of a power plant, the generators, transformers, etc., need be no different when using atomic energy. The costs allowed for these items as well as the turbines are the same as for contemporary construction.

Economies of constructing and operating an atomic pile power-generating plant will be discussed in the ensuing installment.

Measuring Cable A.C. Capacitance and Inductance

LOREN H. HUTCHINS, JR., *Assistant Cable Engineer, Simplex Wire & Cable Co., Cambridge, Mass.*

Methods and equipment employed in cable factory are also applicable to utility laboratory and field tests

SPECIFICATIONS for low-frequency cables (especially for communication) fix a limit on the value of shunt insulation capacitance to ground for individual conductors. If conductors are inductively loaded, i.e., wrapped with fine wire, maximum values of series inductance and a.c. resistance are also specified. Insulation power factor, also called dielectric loss factor, is not generally a cable test requirement at this time, and is therefore not determined in factory tests of a routine character. It is measured, however, in laboratory control tests, in which limits therefor must likewise be met. Hence at various production stages in manufacturing it becomes necessary to measure the three parameters, R, L, and C. During factory processing various preliminary tests are made to insure maintenance of electrical quality, and final tests are made to satisfy the purchaser that his requirements will be met. To insure efficient and expeditious testing a combined capacitance-inductance bridge has been designed and constructed, and this is applicable to field and laboratory testing of cables by users as well as by manufacturers.

Primary electrical requirements were for convergence of balance, simplicity of switching in changing from C to L measurements, and directness of reading. Experience with various bridge networks indicated that the best circuit for capacitance measurements would provide a direct comparison between the capacitance under test and a fixed standard capacitance. These requirements led to the selection of a modified Schering bridge circuit for capacitance measurements and a capacitance-standard Maxwell circuit by series substitution for inductance.

The schematic diagrams of the two networks are shown in Fig. 1. These meet the requirements very satisfactorily. The two conditions of balance in the Schering bridge are entirely independent, thus making for rapid convergence. But one major impedance change is necessary in switching from the Schering to the Maxwell circuit; and with proper choice of bridge-element values, both networks become practically direct reading. When the Schering circuit is balanced

$$C_x = (C_p/Q)S \quad (p.f.)_x = \omega S C_s \quad (1)$$

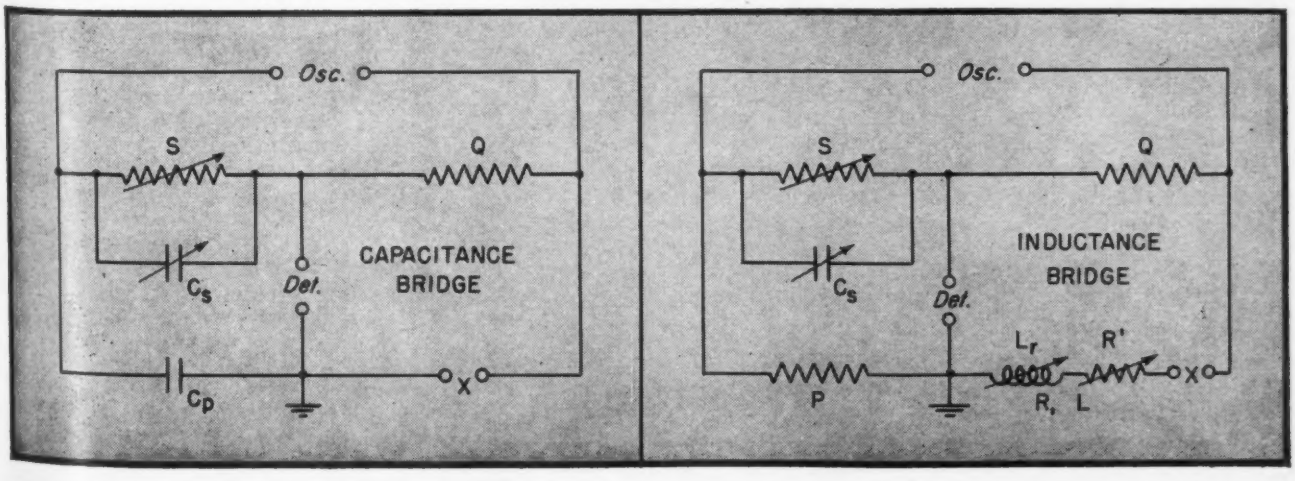
so that if C_p has a value of 0.10 mfd. and Q is made a multiple of 10, S will read directly in capacitance units. The Maxwell conditions for balance are

$$SR = PQ = L/C_s \quad (2)$$

where L is the total inductance and R the total resistance in the arm containing the unknown. Thus, with the X terminals short-circuited, if Q, P and S are given values of 1,000 ohms each and L_r held constant, adjustment of R' and C_s will achieve balance. With the short removed and the test cable inserted, balance is restored by changing only L_r and R'. The desired values are then simply given by

$$L_x = \Delta L_r \qquad R_x = \Delta R' \quad (3)$$

FIG. 1—Basic circuits employed in capacitance and inductance bridge set-up



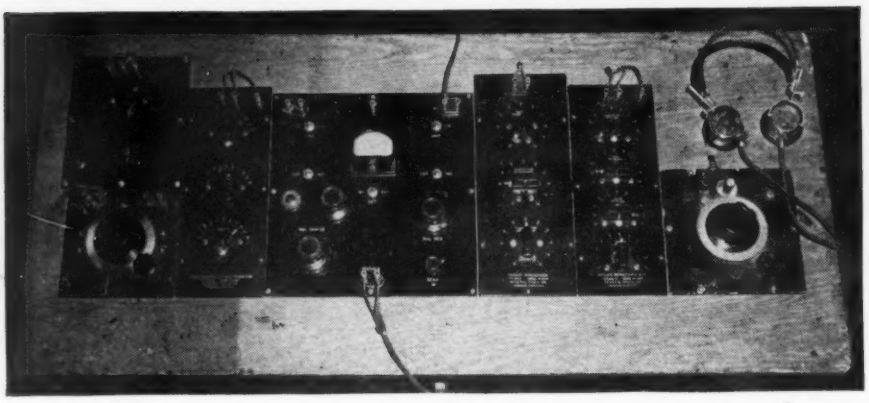


FIG. 2—Top of bridge unit and location of variable elements and test panels

In actual practice, operation of the bridge is not quite so simple, as various refinements and additions to the networks must be made to obtain the desired results.

Convenient Arrangement

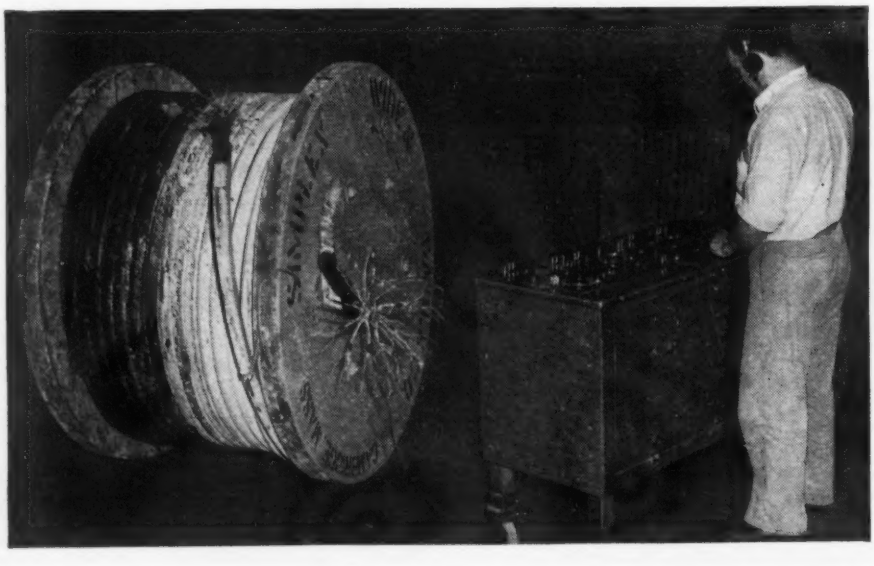
Fig. 2 shows the location of the different variable elements relative to the top of the bridge unit. At the extreme left are the ratio arm, with steps of 1, 10, 100 and 1,000 ohms (3, 30 and 300 are available if desired), and the variable inductor, L_r, with a range of 6 to 50 millihenries. Next is a compensated decade resistor R', with a limit of 111 ohms in 0.1-ohm steps. At the right of the center panel is a decade condenser C_s adjustable to 1.11 mf. in 0.001 mf. steps. Beyond it is a decade resistance box S, maximum value 1,111 ohms with 0.1-ohm increments. At the extreme right is a 1,500-mmf. variable air condenser (also C_s) covering the smallest changes of the decade. These are the units directly concerned with the measuring procedure, values of which must be known. There are other units in the bridge circuits which need not be calibrated.

To compensate for test-lead capacitance, a 12-ohm potentiometer is in series with S and a 1,000-mmf. air and mica condenser combination in parallel with the X terminals; these are mounted under the center panel at the left and marked "BAL CONDS."

Compensation

In order to compensate partially for the zero-setting capacitance of C_s, a 500-mmf. air condenser is shunted across Q. The control knob is shown on the ratio-arm panel. A 1,000-ohm potentiometer is in series with R' for L measurements, so that equation (2) may be satisfied with R' set at exactly 50 or 100 ohms for the short-circuit balance, and thereby facilitate computation. This appears on the center panel as "BAL RES." Three switches are necessary to change from one bridge circuit to the other. One on the ratio-arm panel removes the shunting condenser across Q, and the one on the left of the center panel interchanges C_p and P; while the one on the right inserts or removes the series inductance and resistances in the R arm.

FIG. 3—Bridge unit set up with cable on reel for testing a.c. inductance and capacitance. Portability and easy handling are attained. Table-top construction permits rapid balancing and easy servicing



Although low-frequency cables may be operated in telegraph (0-20 cycles), power (25-60 cycles), voice (100-3,000 cycles), and/or carrier (4,000-30,000 cycles) circuits, the usual frequency for capacitance measurements is 1,000 cycles. This is also true of inductance measurements, but occasionally 5,000 cycles is used. For this reason, a 1,000-cycle tuning fork oscillator is installed in the bridge cabinet; but terminals are provided for the connection of an external oscillator when other frequencies are necessary. All the impedance elements are completely shielded from each other and from ground, and the shields of all but C_p tied together. The standard condenser shield is grounded, and the element itself, together with the standard resistor P, is mounted inside the cabinet. A grounded shield surrounds the entire bridge unit, thereby fixing all earth capacitances. The oscillator is connected to the bridge by a double-shielded transformer with grounded primary shield. The detecting amplifier is a 3-stage battery-operated unit run at a relatively low stage gain for stability. This is also completely shielded and tied to ground, thus obviating the necessity of a shielded output transformer. Balance may be detected either aurally by telephones or visually by a d.c. micro-ammeter mounted in the center panel.

Because of its electrical precision and accuracy, and its good physical characteristics, a bridge of this design should be an excellent tool in the hands of power distribution engineers. Field and laboratory technicians would find it very useful in making life and aging studies of cables both in service and for research purposes.

CONCRETE PILES

Make Economical Tower Footings

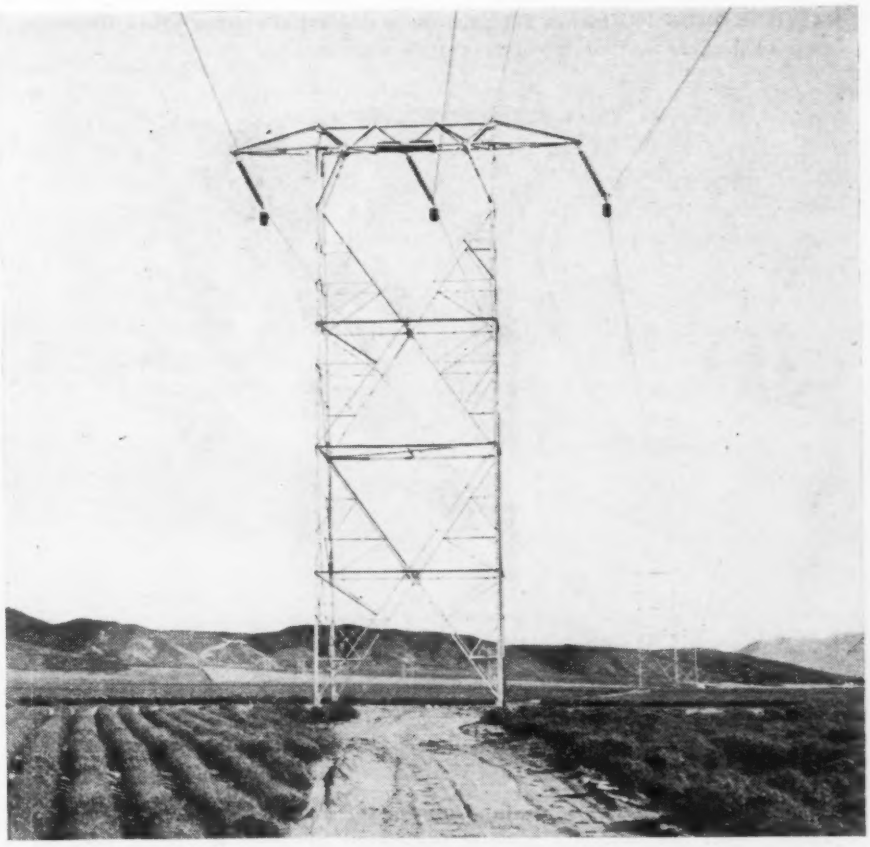
Cast-in-place concrete pile tower footings provide nice balance between theoretical requirements and maximum use of mechanized equipment for lowest possible footing cost. Typical footing for 220-kv. transmission tower costs approximately $110 per leg

JORDAN LUMMIS, *Transmission Engineer, Southern California Edison Co. Ltd., Los Angeles, Calif.*

STRUCTURAL STABILITY, economy of installation, and resistance to deterioration are the three essentials of a transmission tower footing. In an effort to combine the stability and permanence of concrete with the economy of machine excavation the Southern California Edison Co. Ltd. has developed cast-in-place concrete piles for use in its recent transmission line construction programs. That this footing offers a nice balance between the theoretical requirements of design and the practical necessities of construction has been demonstrated under widely diverse circumstances. Where medium quality pit-run or better aggregates are available; where tower sites are accessible to power equipment; where skilled labor is scarce, and where soil conditions are, or can be made favorable for machine excavation, pile footings have proved economical.

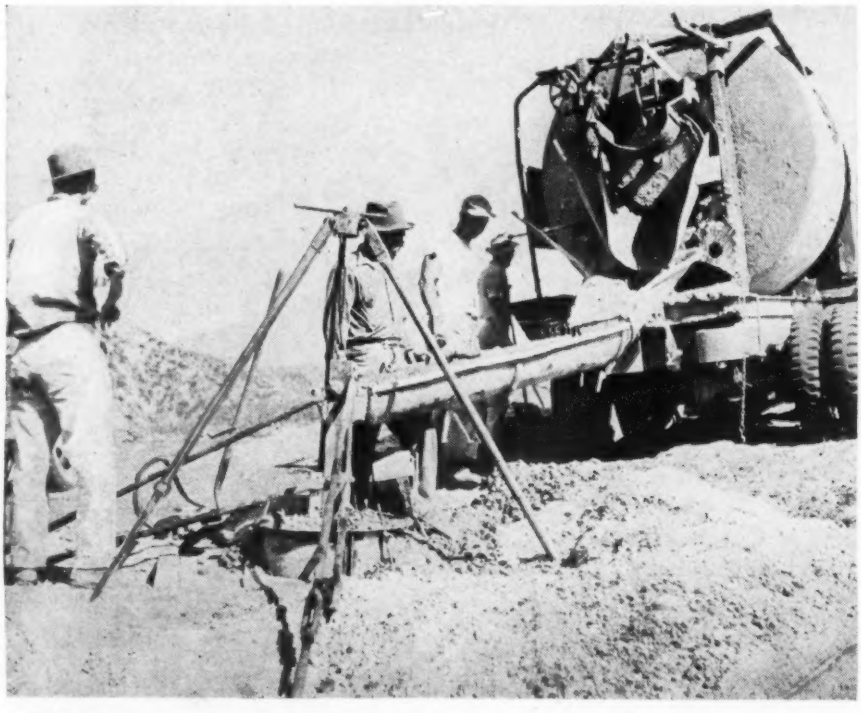
Essentially the footing consists of a vertical hole filled with concrete. The concrete is reinforced with a steel cage and a stub angle is cast in the concrete for connection to the tower. The forces from the tower are resisted in several ways: upward thrust by the weight of the footing plus shear against the earth, downward thrust by shear plus direct bearing on the bottom of the footing; side thrust by lateral bearing against the earth. Since the footing is poured directly against undisturbed earth, the full bearing and shear values of the native soil are available to resist the forces imposed. The footing acts as a beam subjected to simultaneous bending and direct stress and the magnitude of these factors will determine the amount of reinforcement required. For a given set of loads the diameter and length of the footing will vary with the shear and bear-

TYPE of 220-kv. tower that is supported on cast-in-place concrete footings on third Boulder transmission line built by Southern California Edison Co.



ing capacities of the soil. Soil characteristics may be determined in the laboratory from samples, or better, by full scale tests in the field. In any case, it is usual to assume that both the shear and the bearing values of the soil increase uniformly from zero at the ground surface to a maximum at the bottom of the footing. For design purposes, then, the average shear can be assumed as resisting vertical movement over the entire buried portion of the footing. In the case of lateral movement it is usual to assume that the footing is a rigid body tending to overturn against an elastic mass whose resistance increases uniformly with depth. Bending stresses are, then, characteristic of a beam with parabolic loading.

MACHINE DIGGING makes for greatest economy in setting tower footings. Cesspool diggers as well as rotary augers may be used



POURING the concrete pile footing. Form for projecting concrete is a steel cylinder, split and hinged. Stub is supported in position during pouring

When the site is accessible, the excavation can be most economically performed with powered diggers. Several types of such diggers can be used for this type of excavation, but cesspool diggers and rotary augers are probably best fitted for the work. The cesspool digger will excavate to any depth likely to be required, but if the hole is within the range of the auger the latter's greater speed makes it more economical. Moreover, the auger will remove larger boulders and with greater facility. The diameter of the auger should be somewhat smaller than the nominal diameter of the footing since some over-break is inevitable. On the other hand, the size of the boulder that can be excavated decreases with the size of the auger. Where oversized holes cannot be avoided, some measure of economy can be attained by decreasing the depth, but the least concrete will always be used where the diameter-depth ratio is a minimum.

Power Digging

Rotary augers will drill economically in various soils ranging from fine, loose sands to coarse cemented gravels. Dry soil that tends to slough or ravel can be stabilized by being jetted with water prior to excavation. A small pump on a tank truck, with a flexible hose leading from the pump to the nozzle, is effective in this type of work. A $\frac{3}{4}$-in. iron pipe as long as the footing is deep makes a satisfactory nozzle. One penetration of the nozzle is usually sufficient to stabilize the soil well beyond the sides of the hole and keep it stabilized until the concreting operation has been completed.

A skillful operator can remove a surprisingly large boulder with the auger. Boulders beyond the capacity of the auger may be removed by hand. Tongs also can be used for this purpose, or the boulder can be broken up with explosives. Augers with hard-faced cutting edges will penetrate material difficult to remove with a pick, but the process may be too slow for economy. In this case, a single hole can be bored with a pneumatic drill and the soil loosened with an explosive charge. More charges will loosen the hardest rock,

and the auger will actually remove the shattered material, but removal by machine of a mass of broken, hard rock is of doubtful economy, and it is usually better to excavate such ground entirely by hand.

Difficult Locations

Excavation in inaccessible locations or in material too indurated for machines can be done by hand. A workman cannot do effective work in a hole less than 30 in. wide, a much greater diameter than required for the common run of footings in favorable materials. In good rock, the effect of the pile footing can be gained without excessive excavation by removing the loose material down to sound rock and drilling 2-in. diameter holes beyond. Reinforcing steel is secured in these holes with grout or sulphur, and the portion of the footing above rock is formed and poured like a footing in earth.

Reinforcement for the pile footing is shaped to a cylindrical cage, similar to the reinforcement of a round column, with the vertical bars tack-welded to the horizontal ties. This fabrication is done at a central location and the assembled cage carted to the tower site. It is believed more economical to make the cages overlong and then burn them to fit specific footings, rather than attempt excavation of each hole to its exact depth. The cage can then be supported in place simply by standing it on end in the hole.

Stub Embedded

The stub consists of a structural steel angle, and is embedded in the concrete only so far as necessary to develop the tower loads in bond stress. It may be electrically connected to the reinforcement and if this is done the tower will be most effectively grounded. The stub is supported in position during the concrete process with a tripod and with struts, all bearing on the ground well beyond the periphery of the footing. The form for the projecting portion of the concrete is a steel cylinder, split and hinged. If made long enough for the greatest projections the forms extend below the ground surface for lesser projections. In this case, a certain amount of excavation is necessary to permit removal of the form, but this is believed more economical than maintaining a large number of forms of varying length.

COMPLETED FOOTING. Under average conditions footing for an upthrust of 31,000 lb. and side thrust of 8,300 lb. can be set for about $110

Where transit-mix concrete plants are nearby it is generally worth-while to make use of their facilities, but it is not economical to set up central batching plants exclusively for the work. As so far experienced, concrete for footings does not exceed 30 cu.yd. per mile of transmission line, and either the cost of the plant cannot be absorbed by the small amount of concrete within range or the cost of hauling becomes excessive. In these circumstances mixing at the site of the footing becomes economical. Mixing plant can be competely motorized, with the mixer on one truck and the water supply on another and with two or more batching trucks for hauling aggregates. The mixer is mounted high enough to permit chuting to at least two of the four footings with a single set-up, but the hopper is so arranged that the aggregate can be dumped directly into it. The concrete is compacted with an electric vibrator driven by a gasoline generator mounted on one of the trucks.

Moisture Sealed In

The exposed portion of the concrete is cured by sealing in moisture with a coat of coal tar pitch cut-back. The buried portion of the concrete cures satisfactorily without any precaution other than cursorily predampening the sides of the excavation. No matter how dry or porous the surrounding soil it does not withdraw an excess of moisture from the concrete.

A typical pile footing capable of safely withstanding an upthrust of 31,000 lb. and a side thrust of 8,300 lb. in moderately firm soil has these characteristics:

Diameter	18 in.
Projection	12 in.
Depth in ground	11 ft.
Reinforcement	9¾-in. reinforcing straight bars
Ties	10¼-in. reinforcing hoops
Concrete (minimum)	21 cu.ft
Approximate cost per leg including overhead	$110 each

LUMINOUS CEILINGS *for*

The Frink Corporation

VIEW from delegates' table through auditorium

ONE of the spectacular features of the lighting in each of the two large auditoriums of the new semi-permanent home of the United Nations at Lake Success, L. I., will be a continuous blanket of uniform and soft white light covering the entire ceiling space.

This effect will be achieved by the use of closely spaced rows of fluorescent lamps behind a continuous framework of white enameled crossing louvres, forming square openings. The ceiling of each auditorium measures about 6,000 sq. ft., and it is believed that this is the largest lighting installation ever attempted of a continuously louvred ceiling.

Although this general illumination will provide light of an unusually high level at desktop height, it will not result in any feeling of uncomfortable variations in brightness or glare. The depth and spacing of the louvre fins will cut off direct view of the fluorescent lamps to about 30 deg. And even a spectator looking straight up towards the ceiling will not experience too great a contrast in lighting because the individual lamps will be of comparatively low brightness and will be seen against a background of white acoustical-tiled ceiling.

The combination of white ceiling and louvres, closely spaced white lamps of low brightness, and the design of the louvre framework is counted on to reduce variations in brightness to a minimum. And the resulting light at reading level of about 55 foot-candles will provide seeing advantage unusual in so large an auditorium.

Each of the new halls will accommodate between 700 and 800 persons.

Conversion of the former large industrial space into a suitable setting for the United Nations meetings was designed by Voorhees, Walker, Foley and Smith, New York architects and engineers. Ralph T. Walker is the architect in charge, assisted by Victor Hugo, architect, and Alex Sitkin, electrical engineer. General Electric engineers assisted in planning the lighting installation. The builder is Robert Glenn and the electrical contractor B. Eichwald & Co.

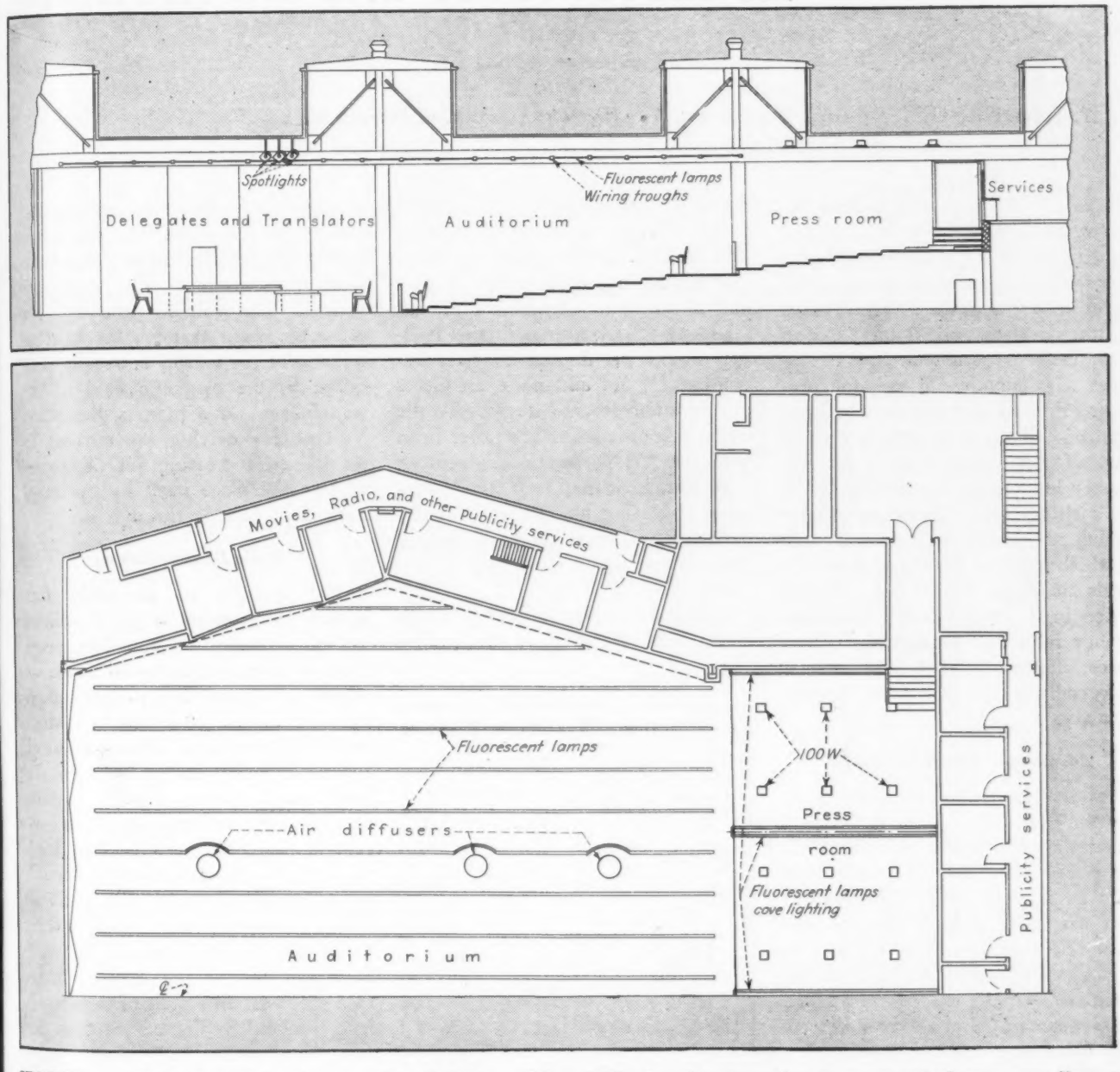
The principal lamp used for general illumination is the new General Electric 60-in., 40-watt T-17 fluorescent in the 4,500-deg. white color. There are 500 lamps in the ceiling, total tube length 2,500 ft. The general illumination is supplemented by special lighting for motion picture and television cameras. Twelve 1,000-watt spotlights are focussed on the delegates' and interpreters' tables and these lights can be turned on and off by the cameramen from their special booths at the rear of the chambers.

The press gallery area in the rear of each auditorium is lighted by incandescent lamps. In each of four bays there are six 100-watt incandescent lamps housed in 8½-in. square lens reflectors.

An interesting adaptation of the original modern industrial lighting system was made in converting the former factory into two auditoriums. The factory had been lighted with continuous wiring channels spaced 13 ft. 4 in. apart, employing two 100-watt fluorescent lamps in closed-end RLM reflectors. Since the wiring channels were continuous, a large saving was effected by using the existing troughs and mogul bipin sockets. The industrial type reflectors were removed and a blank white cover plate placed over the troughs which were replaced by others on 5-ft. centers with existing equipment.

The 100-watt lamps were replaced with 40-watt lamps equipped with G.E. Tulamp instant start ballasts. Because of the multiplicity of speaker and radio circuits in the halls, a G.E. radio interference filter is mounted in the wireway with each pair of ballasts. There are hundreds of microphones and speaker lines which

United Nations Auditoriums



SECTION and half plan of luminous ceiling lighting. Other half of auditorium plan is symmetrical on center line at bottom. There are two such auditoriums, one for the Social and Economic Council and the other for the Security Council

run throughout the area, as well as radio pickup systems which supply the networks of 600 radio stations throughout the world.

The ceiling proper, finished in white acoustical tile, is 17 ft. 9 in. above the floor. The fluorescent lamp fixtures hang down about 12 in. below the ceiling, and the bottom of the louvres, which are 6 in. deep, is about 15 ft. above the floor level.

The louvres, manufactured by The Frink Corporation, are of No. 14 gage aluminum, with a sprayed and baked white enamel finish. They are supported by 3-in. steel T bars with lateral tie-straps to assure alignment. The louvre openings are approximately 10 in. square, and the louvre frames are held by spring catches and are removable in sections 2 ft. 6 in. wide by 5 ft. 6 in. long. Cleaning and maintenance will be facilitated by the fact that there are no horizontal light reflecting surfaces to gather dust and the entire area is air conditioned. Based on expected use, it is estimated that the fluorescent lamps will not have to be changed more than once a year.

SIXTY-CYCLE INDUCTION HEATING

Its Advantages and Limitations

C. A. ANDERSON, *Research Department, The Detroit Edison Co., Detroit, Mich.*

SIXTY-CYCLE induction heating began when the first 60-cycle generator came up to speed and it has continued ever since in the unavoidable heat losses produced in the magnetic cores of transformers and motors and in other metal parts of electrical equipment. Its commercial use, for producing desired heat in a desired location, dates back to at least the early part of this century when low-frequency induction furnaces were built for melting steel. These were later abandoned for several reasons, one of which was that the strong magnetic fields produced too violent stirring action in the molten steel. Low-frequency induction brass melting furnaces, however, are used almost universally today in the wrought brass industry.

Advantages and Limitations

Sixty-cycle induction heating is low in first cost. This is because generating equipment is located in the power plant and the user needs only an inductor coil. The heating unit can have a high thermal efficiency because the only losses are inductor coil losses. Heat losses in the laminated iron core are negligible when the core is properly designed and assembled. While the heating unit is compact and requires little maintenance, it has disadvantages too.

Principal disadvantage of 60-cycle induction heating—as this article will explain—is the need for a laminated iron core on all but the largest pieces. Difficulties in locating such a core exactly where it is needed removes 60-cycle induction heating from competition with higher frequencies on most induction-heating work. In heating small pieces the magnetic saturation of the iron core prevents use of 60 cycles even though the shape of the piece permits the use of an ideal design of core. In the field of localized heating, as exemplified by surface hardening, each depth of case has its minimum frequency for attainment. Sixty-cycle induction heating would be limited to hardness depths of $\frac{1}{4}$ in. and more on pieces of 6-in. diameter and larger. To the writer's knowledge it has never been used for this purpose.

Requirement that each 60-cycle induction heating unit be individually designed and built for each heating task means that it is strictly a production tool.

Induction heating is just as much a question of I^2R as is the heating of resistance wire in an electric toaster, for example. The difference lies in the location of the magnetic field that produces the necessary voltage. The voltage necessary for driving current through the heating element of the toaster is usually produced by the magnetic field in the transformer on a pole in the alley. Voltage for driving the current in an induction heating job is generated in the piece itself by the magnetic field passing through it.

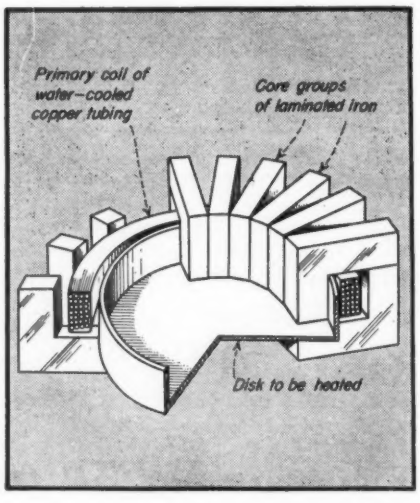


FIG. 1—Core and coil arrangement for heating the rim of steel dish. Core of laminated L-shaped pieces of transformer iron are assembled in groups and spaced around dish rim. Lower core groups are anchored to a steel base plate and remain stationary as does primary coil. Upper groups are fastened to an upper plate (not shown) and can be lifted off to permit removal of work

Basic Considerations

The amount of magnetic flux needed to generate a given voltage varies inversely as the frequency. Thus it takes ten-thousand times as strong a magnetic field to generate a given voltage at 60 cycles as it does at 600,000 cycles. Production of magnetic fields in air sufficient to heat small pieces would require enormous 60-cycle magnetization currents and any heat produced by load currents generated in the work would be small as compared with the I^2R losses in the inductor coil. Power factor and efficiency would both be low. For this reason the provision of a magnetic flux path of laminated iron is useful in all cases of 60-cycle induction heating and indispensable in many cases in order to obtain a high magnetic flux density at a reasonable value of magnetization current.

Shape of the work piece determines whether a coil and laminated iron core can be built to fit it. Even where the shape of the piece permits a completely encircling magnetic core, it may be impossible to obtain the desired power input on pieces below 3-in. diameter because saturation of the iron prevents the small core from carrying sufficient mag-

netic flux. Iron saturates at about 120,000 flux lines per sq. in. and any additional magnetic flux above the saturation point in the iron costs as much, in terms of magnetization current, as it does in air.

Factor of Size

In general the sizes of the pieces heated in most induction heating work are too small to permit use of 60 cycles. Three principal factors determine the frequencies that can be used:

(a) Size of the piece or portion of a piece to be heated,

(b) Electrical resistivity of the material of which it is made, and

(c) Magnetic permeability of the material.

Usually there is some minimum frequency required to do the job at all, and a higher frequency that gives maximum efficiency. This is especially the case when only a small portion of the work piece is to be heated, as in surface hardening.

Size is the most important single factor in the selection of frequency. For example, a $\frac{1}{8}$-in. diameter steel rod could be surface hardened to a depth of two or three mils with a frequency of several megacycles, provided the necessary energy could be put in fast enough and the steel quenched soon enough. A $\frac{1}{2}$-in. diameter steel rod could be surface hardened as shallow as 10 mils with 400 kilocycles. A 2-in. steel rod could be hardened to a depth of 50 mils with 3,000 cycles. Doubtless an 8-in. steel shaft could be surface hardened to a depth as shallow as $\frac{1}{4}$ in. with 60 cycles. These depths of hardness are not necessarily minima but are used to indicate the trend.

In general, ferromagnetic materials can be heated in much smaller sizes for the same frequency than can non-magnetic materials, provided of course, the temperatures are below the Curie point. The reason for this does not lie in the added heat produced by magnetic hysteresis, which is generally negligible; rather, it lies in the greatly increased values of flux that can be obtained when the work piece itself provides a good magnetic path.

High-frequency heating usually requires a 60-cycle step-up transformer, a frequency conversion unit, a high-frequency step-down transformer, and an inductor coil; whereas 60-cycle induction heating requires only the inductor coil and sometimes a 60-cycle step-down transformer. The 60-cycle inductor coil usually requires a laminated iron core which increases its cost as compared with the cost of the high-frequency inductor coil, but this increase is not important unless inductor coils must be built frequently for short production runs as in a jobbing shop.

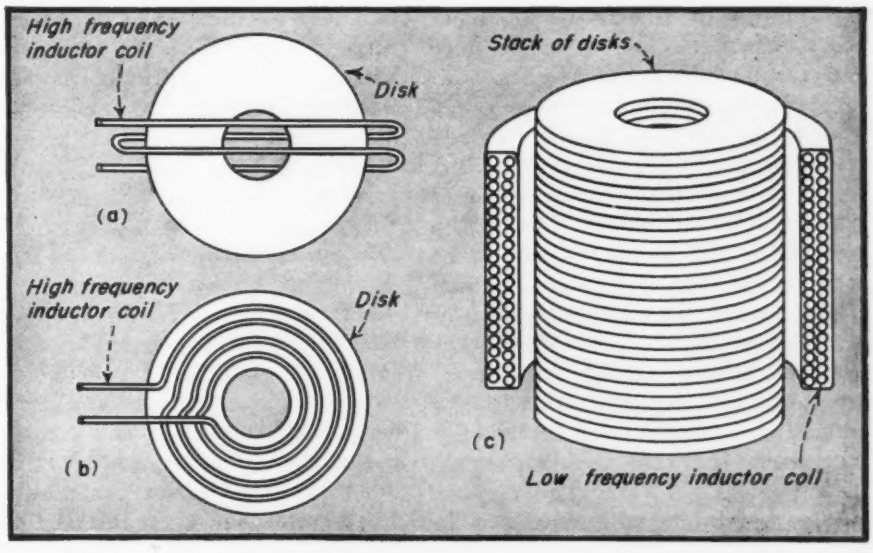
Need high frequency steal the induction heating field or is there a field for 60-cycle induction heating? How do the two compare as to first cost and efficiency? Where is there a basic advantage in use of 60-cycle induction heating over high frequency?

The elimination of the frequency conversion unit carries with it other advantages besides a reduced first cost. All maintenance associated with the frequency conversion unit is eliminated. The only maintenance required by the 60-cycle unit is that required for maintaining any low-voltage, water-cooled transformer. The energy losses incurred in the frequency conversion unit are also eliminated. Over-all efficiencies around 95 percent are not unreasonable in properly built 60-cycle induction units. The space occupied by the frequency conversion unit is freed for other use. That space saving, however, is not great, as most high-frequency induction heating units are rather compact. A final advantage is the user's freedom from power limitations. He is not confronted with the necessity of using a 20-kw. induction heating unit on a 2-kw. job, nor is he faced with the impossibility of doing a 40-kw. job on an existing 20-kw. unit. The maximum power that the user can put into his 60-cycle induction heating unit is limited only by the size of the piece to be heated and by the power company's ability to deliver power.

Applications

Sixty-cycle induction heating has been much used during the war for expanding parts for shrink-fit assemblies. This use requires temperature

FIG. 2—Optimum frequency for induction heating depends on coupling between coil and work. In (a) best frequency is determined by half the disk thickness. In (b) it is determined by full disk thickness and in (c) it depends upon the radial width of the disk from the center hole to the outer edge. Arrangement (c) proved best for 60-cycle heating; optimum frequency was about 45 cycles



rises of only a few hundred degrees F. but it requires high power input when high production speeds are needed. It has been used also for shell nosing operations on large calibre shells. It is even being used for holding elevated temperatures on extrusion dies and nozzles.

Several examples might be cited but this paper will discuss in detail only two specific cases. Heating units in both cases were designed by the Research Department of The Detroit Edison Co. The first example is used to show definite values of size, efficiency, and power input. The second is used because it offers an interesting variety of solutions.

The first example involved the heating of a 3-in. high upturned edge on a 12-in. diameter dish-shaped piece of $\frac{1}{8}$-in. thick mild steel (see Fig. 1.) The encircling core contained over 300 lb. of laminated iron in addition to the steel used in the supporting and clamping structure. The inductor coil contained approximately 10 lb. of $\frac{1}{4}$-in. copper tubing. The 28 turns of the coil were all in series electrically, but were connected into three parallel paths for water cooling.

Dish-Shaped Piece

The 3-in. band was heated to 1,200 F. in 6.5 seconds with an average power input of 125 kw. fed directly from a 480-volt supply. The average power factor was 69 percent, with a peak of 82 percent midway in the heating cycle. The efficiency of the unit based on the actual energy put into the piece was over 90 percent. In this connection it should be stated that the heat pattern did not end abruptly at the edge of the 3-in. band but tapered off to zero temperature rise in the adjacent two inches.

A few changes in the design of this induction heating unit could be made to shorten the heating time to perhaps four seconds with a corresponding increase in kw. input. This is the practical limit, however, and further efforts to shorten the heating time would unduly decrease both efficiency and power factor.

This heating unit is an integral part of a proposed production scheme and has been operated successfully on several trial runs. Continuous production has not yet started because a few difficulties still remain to be settled in other parts of the scheme. No provision was made for cooling the laminated iron core during the trial runs and it is anticipated that none will be needed during continuous production.

Non-Magnetic Alloy

The second example involved the heating of non-magnetic chromium steel. It is of interest because of the wide range of frequencies that would be required depending on the manner in which an inductor coil was to be applied. The material is an alloy similar to 18-8 stainless steel as far as its electrical resistivity, magnetic permeability, and thermal conductivity are concerned. The piece is in the shape of a large thin washer with an outside diameter of 20 in., an inside diameter of 7 in. and a thickness of 1/16 in. A uniform temperature was required across the faces of the disk.

If the disks were heated by passing them one at a time through a long flattened coil, like pennies through a slot, see Fig. 2(a), the minimum frequency for best coupling efficiency would be nearly 2 megacycles. If the disks were heated one at a time by being held stationary for the required length of time under a pancake coil, (see Fig. 2(b)) the minimum frequency for best coupling efficiency would be around 400 kilocycles. If the disks were stacked in a pile and the entire pile moved slowly through a long concentric inductor coil, (see Fig. 2(c)) a frequency of 60 cycles would not be too low for best coupling efficiency. A frequency of 60 cycles would be undesirable, however, because at that frequency the heat would be generated largely in a 1-in. deep zone at the outer perimeter and would reach the inner edge by thermal conduction only. Because of the poor thermal conductivity of the alloy the heat pattern would be too far from uniform unless the heating and soaking period were unduly long. It would be desirable, therefore, with such a coil arrangement to use a frequency lower than 60 cycles in order to generate the heat in a deeper zone even though it caused a sacrifice in coupling efficiency.

Gas heat, infrared, salt bath, and platen heating had been rejected because of lack of speed, the possibility of marring the polished surface of the disk, or other reasons. High-frequency induction heating, while admittedly fast enough, was ruled out because of high initial cost. It was determined by computation that a 60-cycle induction heating unit consisting of a pancake coil imbedded in slots in a laminated iron core could provide the desired heat pattern in the desired heating time. Initial cost of equipment should be reasonable. The unit has not yet been completed and is still subject to change, so no test results are available.

Electric Tractors Aid Russian Farming

A REPORT entitled "Six Years' Experiments on the Work of Agricultural Electro-Tractors" in Russia, which appeared in 1945, has been translated for the U. S. Department of Agriculture, according to a presentation by T. E. Hienton of that department before the North Atlantic Section A.S.A.E. Two electric tractors were built and used from 1938 through 1943. Both were motor-driven and supplied with electricity through a cable from portable transformer substations. Extensive field work was done by these in plowing, harrowing, cultivation and combine harvesting. It is stated that these units furnished power for plowing 1,000 hectares (2,471 acres) in 1942. The cost of electricity was figured at less than one-third that of fuel and oil in a tractor with an internal combustion engine, the rate per kilowatt-hour being 0.12 rubles, or 2.4 cents at the standard rate of exchange.

It was concluded that the cable method of power supply was fully reliable. The simplicity of construction, high working qualities and great economy have produced a high appreciation of these machines by members of collective farms and workers of machine tractor stations. A broad possibility of service appeared in areas having suitable distribution networks, notably in vegetable and large suburban farms.

Steps In The Planning Of

A RURAL SALES DEPARTMENT

J. D. HOWARD, *General Sales Manager, Wisconsin Power & Light Co., Madison, Wis.*

Philosophy and procedure followed by a Wisconsin utility in planning its rural sales organization. Outline covers market analysis, organization for selling and dealer relations for a five-year program. A new salesman compensation plan is proposed

PLANNING a rural sales department will convince anyone of the need for wisdom in objective thinking, for skill in know-how, and for conviction and fortitude in putting the plan into action. These components of planning are involved repeatedly in measuring market potential, organizing a sales staff and establishing program objectives. In setting up its rural sales program, the Wisconsin Power & Light Co. foresees the sale of $15,000,000 in electrical goods and services by the company and its cooperating dealers to some 31,000 farm customers by 1950.

This forecast of rural market potential for the five-year period beginning 1945 was the first step in organization planning for our rural department and involved the examination of census, sales-volume and survey data. Starting with the company's 23,116 rural customers of January, 1945, analysis of unserved farms and other establishments by townships led to the estimate of ultimate practical saturation of service connections shown in Table I.

Farm customer saturation foreseen by 1950 is 83 percent. This compares with a 1945 saturation of 62 percent and will require an increase of 7,847 in the number of farms presently connected to this system. We contemplate that this increase will be achieved by connection of those customers now holding approved service applications plus half of the remaining unserved farms in the area as of the end of 1944.

Potential business represented by this block of rural customers for the period of 1945 to 1950 is recorded in Table II and is based on several assumptions:

1. Expected expenditure, for wiring, of $150 by each newly connected farm customer and $40 by each existing customer.

2. Electrical equipment sales are expected to total $400 for each new customer and $300 for existing customers during the five years.

3. For plumbing and water systems it is anticipated that one-third of the new customers will spend $225 by 1950, and that half of the existing customers will spend an equal amount.

4. Of the resulting aggregate sales of equipment and service of $15,364,365, it is contemplated from past experience that the company will sell about 15 percent, and that cooperating dealers will handle the balance or $13,853,000.

Significant fact in interpreting these estimates of customer saturation and market potential is that they are based on a five-year period. This lengthened estimating interval arises from the conviction on our part that farm electrification is primarily an *educational* task. It is, therefore, considered desirable to lay out a program to take account of the cumulative effect of educational effort over a period of years. Our experience indi-

CUSTOMER SALES RECORD—To control rural sales activities and record pertinent data about each farm customer this card provides rural sales supervisors with an effective check on customer contact by rural salesmen. The reverse side provides space for call reports and consumption data

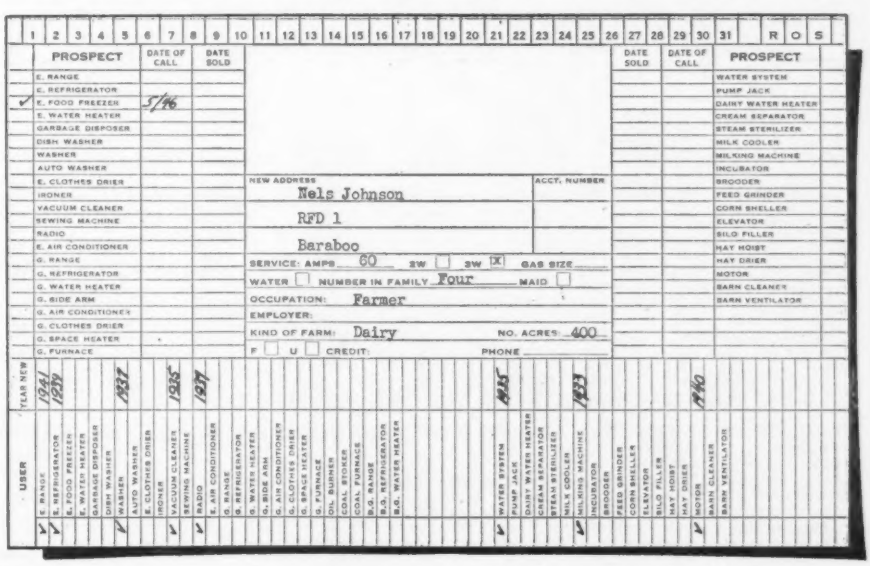


TABLE I—ANALYSIS OF RURAL MARKET POTENTIAL . . . Customers
April 1945

District	(1) Rural Customers Served 12-31-44	(2) Additional Service Applications Approved 12-31-44	(3) Prospective Customers Without Service 12-1-44	(4) Total Rural Area Outlets	(5) Prospective Customers To Be Added By 12-31-49 Col (2) plus 1½ of Col. (3)	(6) Total Rural Customers Served By 12-31-49	(7) Percent Saturation
A	540	55	1,445	2,040	777	1,317	65
B	1,677	93	929	2,699	557	2,234	83
C	2,060	122	1,251	3,433	747	2,807	82
D	1,044	59	924	2,027	521	1,665	82
E	1,308	109	962	2,379	590	1,898	79
F	1,572	33	262	1,867	164	1,736	92
J	444	0	60	504	30	474	94
K	3,536	267	1,089	4,892	811	4,347	90
L	3,217	211	1,133	4,561	777	3,994	87
M	1,120	2	62	1,184	33	1,153	97
N	1,484	39	261	1,784	169	1,653	92
P	1,385	61	495	1,941	308	1,693	87
S	725	8	88	821	52	777	94
Y	3,004	352	3,918	7,274	2,311	5,315	73
Total	23,116	1,411	12,879	37,406	7,847	31,063	83

cates that short-range objectives may be misleading, even dangerous. It is our conviction that one-year estimates and program objectives do not allow for accurate result appraisal.

Three investigations were made in arriving at a decision as to how many rural salesmen would be needed to capitalize on the market potential indicated in the forecasts:

1. A time study of the duties to be performed by rural salesmen.

2. Sales production potential of rural salesmen.

3. Meter reading functions; to determine what employees should read rural meters, the time required to read meters and the cost.

A study of a rural salesman's duties was difficult because of the many varying factors. The basic objective was to have an organization which would call on every customer during a period not to exceed 18 months; this requires an average of about two survey calls per day. The primary purposes of such calls are to develop friendly customer relations, to determine the appliances and equipment each customer is using, to render service to all customers and to sell.

Sales production of each salesman was tabulated and analyzed for the six years 1936 through 1941 as a basis for predicting future production in company retail sales.

A meter-reading study was carried on over a three-month period with a view to determining as accurately as possible all factors appertaining to the subject. For example, it was found that eleven types of employees involving 86 persons were reading rural meters. They read an average of 12.05 meters per hour at an indicated cost of 11.45 cents per meter.

Resulting directly from these investigations were two decisions: That rural salesmen should *not* read meters and that one salesman should be assigned to about 800 farm customers. This ratio indicates a staff of field salesmen approaching 40 in number by the end of the five-year program. At the outset, however, a field staff of about 30 appears ample.

Recruiting, interviewing, testing and selection of such a rural sales force called for development of recruiting literature, an interview guide, standardized rating sheet, aptitude tests and a routinized interviewing and selection procedure. Several obvious misplacements of personnel were avoided through use of these employment tools that were developed for the purpose by the company personnel department.

Preparation and training courses for rural salesmen, now being conducted, were designed to provide new rural sales employees with information on each type of sales activity and their duties. To compile the instructional material for these courses, veteran sales employees were asked to assemble an outline of their duties covering work accomplishment; necessary information about the company, its organization, rates and rules; handling of customers, sales techniques, the handling of complaints, etc. These outlines have been combined into a master outline covering 53 major sales subjects of which 29 are common to all sales positions. The remaining 24 cover specialized fields. It is around this master training outline that the continuing program of training has been built and is being conducted.

Sales Supervision

Effective coverage of the company service area by rural salesmen requires a carefully coordinated system of supervision to insure that each rural customer is contacted regularly and in a manner that will justify the effort economically.

To each company district will be assigned a number of rural salesmen depending on the number of farm customers in the district. These men will operate under the direction of the district sales supervisor who in turn will be guided through the district

TABLE II—ANALYSIS OF RURAL MARKET POTENTIAL . . . Sales
April 1945

Estimated Normal Average Expenditures For 5-Year Period

DISTRICT	(1) WIRING	(2) NEW ELECTRICAL EQUIPMENT	(3) PLUMBING AND WATER SYSTEMS	(4) TOTAL	(5) DEALER MARKET	(6) COMPANY MARKET	(7) AVERAGE PER YEAR DEALER	(7) AVERAGE PER YEAR COMPANY
A	$138,150	$472,800	$119,025	$729,975	$659,055	$70,920	$131,811	$14,135
B	150,630	725,900	230,437	1,106,967	998,083	108,885	199,617	21,777
C	194,450	916,800	287,775	1,399,025	1,261,505	137,520	252,301	27,504
D	119,910	521,600	156,525	798,035	719,795	78,240	143,959	15,648
E	140,820	623,400	191,400	960,620	866,360	94,260	173,272	18,852
F	87,480	537,200	189,150	813,830	733,250	80,580	146,650	16,116
J	22,260	145,200	52,200	219,660	197,880	21,780	39,576	4,356
K	263,090	1,385,200	458,625	2,106,915	1,899,135	207,780	379,827	41,556
L	245,230	1,275,900	420,188	1,941,318	1,749,932	191,385	349,986	38,277
M	49,750	349,200	128,475	527,425	475,045	52,380	95,009	10,476
N	84,710	512,800	179 625	777 135	700,215	76,920	140,043	15,385
P	101,600	533,700	178,912	819,212	738,408	80,805	147,682	16,161
S	36,800	238,300	85,463	360,563	324,817	35,745	64,963	7,149
Y	466,810	1,825,600	511,275	2,803,685	2,529,845	273,840	505,969	54,768
Total	$2,101,690	$10,073,600	$3,189,075	$15,364,365	$13,853,325	$1,511,040	$2,770,663	$302,210

Note:
(1)—Based on $150 for each newly connected customer and $40.00 for each presently connected customer.
(2)—Based on $400 for each newly connected customer and $300.00 for each presently connected customer.
(3)—Based on $225 for 33-1/3% of the newly connected customers and $225.00 for 50% of presently connected customers.
(6)—15% of Column (2).

manager by consultation with the headquarters staff of sales managers in the several specialized fields; among them the rural sales manager and a farm equipment engineer. This engineer is a technical specialist who will be available to the various districts for consultation on special problems.

Compensation

Salesman's compensation has been a much kicked around topic that requires still further research and study. Our own analysis of the subject brought out some very significant points which led to changes not only in compensation but also organization and responsibilities. In the past several years, we accumulated a compensation plan which paid bonuses and commissions to many of our employees who were not full time salesmen. It included prospect and new customer bonuses, and commissions on appliances and lamp bulbs. A study of our 1941 merchandising operations showed that of $40,496.06 paid in commissions and bonuses, only $14,717.24 or 36 percent went to full-time sales personnel. This study resulted in a major revision in our compensation plan.

In order to avoid some of the shortcomings of the past system of salesman assignments in appliance units, we sifted the problem down to a point system. Under this plan salesmen are allowed a 10 percent assignment bonus based on satisfactory performance of duties assigned by their supervisors; and a second 10 percent sales cost bonus based on gross pay as a percentage of gross sales. Points awarded for company sales of various appliances, as well as estimated annual revenue, are given in Table III. The points were established by weighting resale price, total and net revenue. When merchandise is again available in proper volume, each salesman will be assigned monthly a quota for each appliance he is expected to sell; the number of points are calculated for each appliance and addition of the individual totals gives grand total points. If the salesman makes his grand total points for the month, he has qualified so far as this part of his assignment is concerned. Note that he can make his total points assigned by selling nothing but flatirons. The selective selling control is through proper supervision and the assignment of point value to an appliance. It is contemplated that points will be increased for certain appliances during special promotions so as to stimulate sales of specific items from time to time.

With such a program a strong dealer activity is essential. Control is through regulation of the percentage of the total market that the utility sells. This percentage should be enough to stimulate business competition, stabilize prices and trade-ins and to allow adequate economical promotion so all marketing agencies benefit, but should *not* be enough to capture the retail market. Table IV may be of interest in this regard. In comparing retail appliance and equipment sales by both dealers and by the company for 1941 with estimates for 1947, it shows that company sales are running from 6 to 18 percent of the total sales in various appliance lines handled in competition with dealers. Our ceiling is 20 percent, and it is based on a study made before the war to determine what portion of the volume we should sell in order to stimulate the highest total volume of sales by dealers.

TABLE III—BASIS OF POINT SYSTEM OF COMPENSATION

Points for Company Sales of Residential Appliances

APPLIANCE	ESTIMATED ANNUAL REVENUE	POINTS
Range	$30.00	10
Refrigerator	12.00	5
Refrigerator with Freezer Compartment	16.00	5
Food Freezer	20.00	7
Water Heater	30.00	10
Garbage Disposer		3
Dishwasher	4.00	4
Clothes Washer	1.00	3
Automatic Washer	4.00	5
Clothes Drier	10.00	5
Ironer	3.00	4
Vacuum Cleaner	1.00	3
Sewing Machine	1.00	3
Radio	2.00	3
Air Conditioner	10.00	6
Blanket	3.00	3
Roaster	10.00	4
Small Appliance	1.00	1
Replacement of Bottled Gas Range		10
Replacement of Bottled Gas Water Heater		10
Gas Range	30.00	6
Gas Refrigerator	22.00	7
Gas Water Heater	30.00	10
Gas Side Arm Heater	5.00	2
Gas Clothes Drier	10.00	5
Gas Circulating Heater	30.00	10
Gas Furnace	125.00	40

Points for Company or Dealer Sales of Farm Appliances

EQUIPMENT	ESTIMATED ANNUAL REVENUE	POINTS
Automatic Water System	$15.00	10
Pump Jack	6.00	2
Dairy Water Heater	25.00	10
Steam Sterilizer	12.00	5
Milk Cooler	20.00	10
Milking Machine	8.00	4
Pig Brooder Installation	4.00	3
Poultry Brooder Installation	15.00	6
Feed Grinder	12.00	6
Hay Drier Installation	75.00	20
Motor, 1 hp. or less	3.00	2
Motor, over 1 hp.	6.00	3
Barn Cleaner	2.00	3
Barn Ventilator	20.00	10
Walk-in Freezer	100.00	20
Poultry Lighting Installation	5.00	3
Heating Unit	10.00	3
Radiant or Infrared Heating Unit	4.00	3

TABLE IV—RETAIL APPLIANCE AND EQUIPMENT SALES
(Company Service Area)

Year 1941

ITEM	COMPANY	PERCENT OF TOTAL	DEALER	TOTAL
Elec. Appl.	548,000	10.5	4,654,712	5,202,712
Gas Appl.	77,000	18.0	350,000	427,000
Coml. Appl.	25,000	7.1	325,000	350,000
Lamp Bulbs	54,000	6.8	746,000	800,000
Sub Total	704,000	10.4	6,075,712	6,779,712
Radios	0		1,551,000	1,551,000
	704,000	8.4	7,626,712	8,330,712

Estimated 1947

ITEM	COMPANY	PERCENT of TOTAL	DEALER	TOTAL
Elec. Appl.	986,000	12.3	7,000,000	7,986,000
Gas Appl.	110,000	16.7	550,000	660,000
Coml. Equip.	36,000	7.4	450,000	486,000
Lamp Bulbs	75,000	6.3	1,115,000	1,190,000
Sub. Total	1,207,000	11.7	9,115,000	10,322,000
Radios	0		2,300,000	2,300,000
	1,207,000	9.5	11,415,000	12,622,000

★ *AN EDITORIAL FROM THE PUBLISHER*

SHOULD STRIKES IN ELECTRIC UTILITIES BE

THE public certainly thinks that strikes in electric utilities should be outlawed. Recent Gallup Polls have shown substantial majorities in favor of forbidding strikes in all public utilities. In a recent ELECTRICAL WORLD Survey* 92 percent of customers felt that utilities and employees should arbitrate their differences. Even many executives of industrial companies seem to favor compulsory arbitration as a substitute for strikes in utility companies, while at the same time stoutly objecting to the application of any such doctrine to industry as a whole.

Compulsory Arbitration Not the Answer

Compulsory arbitration as we understand it today would be an unfortunate instrument to use for the prevention of strikes in electric utility companies. An arbitrator when called upon to write the terms of a collective-bargaining agreement has nothing to guide him but his own background, his own sociological views, his own belief as to the share of the company's income the worker should have. With the unlimited scope of the demands made by unions in the course of contemporary collective bargaining, there is no limit to the subjects which an arbitrator might be called upon to decide.

For example, in the case of the Duquesne Light Co.,† the union demanded that all company earnings in excess of 6 percent be distributed one-third to the employees, two-thirds refunded to the customers; the company pay all costs of a liberal pension plan; the company pay all hospitalization plan costs, covering employee, wife and children and to include all medical and surgical costs.

The decisions on some of these questions certainly would have a vital, perhaps even a fatal effect upon the success and continuation of the business.

It is to be noted that there is a great distinction between an arbitrator fixing the terms of a new agreement and an arbitrator settling a question as to the meaning or alleged violation of an existing agreement. In the latter case, he is *interpreting* the agreement, whereas in the former he is *making* a new set of rules to guide the relationship between the parties. One is a judicial process, the other a legislative process.

If a purchaser agrees to buy a house for $15,000 and then doesn't go through with the deal, the owner of the house can go to court and get a judicial decision based on the contract that the parties had signed, and in the light of well known contract law.

But if a person wants to buy a house for $5,000 while the owner is not willing to sell it for anything less than $25,000, in a free country he cannot go to court and demand that the court force the owner to sell at the price offered or at any price that the court may set. The court does not have that power, and should not have it, except in the field of eminent domain.

It is entirely reasonable, when two parties to a contract disagree as to its meaning, to call in a third party to decide what the parties meant when they signed the agreement. It is an entirely different matter when two parties trying to negotiate an agreement cannot agree as to what they want to include in it. Under existing arbitration proceedings, unless the parties stipulate certain limitations, there is no restriction on the arbitrator's authority and anything he decides must be accepted by the parties, no matter how far reaching the effects. The arbitrator, in effect, has complete authority to change important factors affecting the operation of the business without any responsibility for the effects of his decisions.

In addition to the uncertainty that is bound to accompany compulsory arbitration of new agreements without a body of principles to guide the arbitrator, experience shows that compulsory arbitration does not prevent strikes. In Australia, where strikes are illegal and industrial disputes are supposed to be settled by labor courts, there were proportionately more strikes before the war than there were in the United States. And Americans don't take to compulsion any more readily than do Australians.

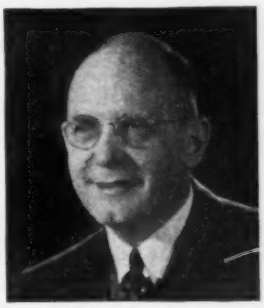
What Is the Answer?

If, then, compulsory arbitration is not the answer, what is the answer? Utility companies are in effect monopolies; this is the reason for setting up regulatory bodies to see that no more than a fair return is made on the investment and the public is charged fair rates for the service rendered. Theoretically, at least, if wages or other costs are increased as a result of collective bargaining, the wage increase will be reflected in higher utility rates to the consumer.

The customers of the utility company are also workers who enjoy certain "hours, wages, and working conditions." In view of the quasi-public nature of the utility company, it seems reasonable that the employees of the utility company should not expect to enjoy wages, hours, or working conditions substantially better than those enjoyed by the workers living in the area served by the utility company. Likewise, it seems that because of

*See ELECTRICAL WORLD, May 25, 1946.
†See ELECTRICAL WORLD, August 10, 1946.

OUTLAWED?



Lee H. Hill, prior to becoming Publisher of "Electrical World" was Vice-President in Charge of Industrial Relations at Allis-Chalmers. He spent half his time during the war as an Industry Member of the National War Labor Board; was a delegate representing industry to the President's National Labor-Management Conference in 1945, and is a member of the Labor Committees of The National Association of Manufacturers and the Chamber of Commerce of the U. S. He is co-author of "Management at the Bargaining Table."

the quasi-public nature of the utility company it should reasonably be expected to maintain wages, hours, and working conditions that do not suffer in comparison with those enjoyed by these same workers.

If these premises be accepted as reasonable, then we have a comparatively simple basis for solving disputes in the utility industry.

A Simple Basis for Settling Disputes

The law might provide that strikes in utilities be outlawed; that utility companies be required to maintain hours, wages and working conditions at the prevailing level in the area served by the utility; and finally that any dispute as to what is the prevailing level in the area be resolved by arbitration. This converts the arbitration proceeding into a determination of facts, a judicial process rather than the legislative process of making law, as it would be if ordinary arbitration were used. The purpose of the arbitration proceedings really is to make the utility employment practices conform to local conditions, not to blaze new trails in employee relations.

For example, the union might claim that the wage level is below that prevailing in the area served by the utility, and the company may disagree. During the course of collective bargaining, the union submits the facts on which it bases its claims of wage misalignment. The company comes up with facts which may not check with those submitted by the union. The facts to be considered, however, are definite. They relate to the wages paid for comparable jobs in the area served by the utility. The level of wages paid by utilities in other parts of the country have no bearing on the problem when the techniques of job analysis and evaluation are used. In those cases in which comparable jobs do not exist in the area served by the utility, the correct wage can be determined by applying these same well known techniques. In determining wage rates, consideration should be given to the stable continuous nature of employment in the utility industry as compared with the seasonal employment in the construction industry, for example. Pension plans and other non-wage compensation should also be considered and can be converted to a cents per hour basis for the purpose of comparing with wages in the area.

But suppose after checking and re-checking each others' figures, the parties still can't agree as to the facts. At this point the parties would select an arbitrator who would make a finding of fact after hearing the arguments and sifting the evidence presented by both sides.

Or suppose the issue of dispute were a non-wage matter. Perhaps the dispute involved the most controversial of union-management disputes—the closed shop.

Under the program outlined, if the company and union were unable to agree as to whether or not the majority of employees in the area served by the utility worked under closed shop conditions, the parties would submit this matter to the arbitrator for final resolution. His finding would settle the question. Under this procedure the arbitration process is no longer a matter of opinion or philosophy on the part of the arbitrator. It is a matter of finding facts. His range of authority is accordingly limited, and his decision becomes more predictable.

Can Do Without a Law

Accordingly, we have here a basis for outlawing strikes in electric utilities. But to put such a program into effect, there is no need for a company and a union who recognize their responsibilities to the public to wait for a law to be passed. The parties need merely enter into a collective bargaining agreement with each other agreeing to settle all disputes on the basis of the practice prevailing in the area served, with disputes as to facts subject to determination by arbitration.

Such a program would minimize the danger of compulsory arbitration being foisted upon them. Even if compulsory arbitration were required by law, this voluntary method of solving their differences would meet its requirement.

By following a simple program such as this, they would effectively avoid the necessity for strikes without subjecting either the company or the union to the hazards of unlimited arbitration. At the same time, this program would recognize the legitimate interests (1) of the public, by assuring uninterrupted service at fair rates, (2) of the workers, by assuring them of wages, hours, and working conditions at least as good as those prevailing in the area, and (3) of the utility, by protecting it against outrageous demands.

Lee H. Hill

WASHINGTON COMMENT

By R. N. LARKIN

Krug Opposes Initiative 166

RECENTLY, Interior Secretary J. A. Krug took unmistakable positions on two major power issues. First, he endorsed unequivocally a TVA-type Columbia Valley Authority. Thereafter, he opposed, again unequivocally, Initiative 166, a Washington statewide referendum.

Krug's CVA position is of broader interest. Still, the chances that any such legislation will be enacted by the 80th Congress are now so slight that Krug's position on Initiative 166 seems the more pressing.

Initiative 166, backed by all major affected power companies except the Puget Sound Power and Light Co., would require P.U.D. commissioners to present to the voters a resolution describing any proposed acquisition of private power facilities and including the specific amount of bonds proposed to finance their purchase.

Unmistakably, 166 requires voters to pass a second time on whether a P.U.D. shall in fact go into business. It is this "second chance" which arouses opposition by public power enthusiasts.

Opponents of 166, headed now by Krug, argue that the public votes on the P.U.D. principle when it votes originally on establishing a P.U.D. Why, they argue, should there be the second chance 166 affords? Why, they ask, would the public approve establishment of a P.U.D. in its first vote if it did not intend that P.U.D. to acquire properties? 166, they insist, is just obfuscation, an attempt to prolong the process where the first vote is lost by a private company.

A Second Chance

Is a second chance necessarily bad? In 17 of Washington's 39 counties, P.U.D. supporters lost the first vote to establish a P.U.D. and enjoyed second, third, and fourth chances. In those 17 counties, P.U.D.'s have thus far had not 17 but 39 chances. In five counties, they had not won in 1942, after 14 chances, yet additional chances—elections—may be had. Apparently in these counties, a second chance is fine—for the P.U.D.'s.

In 19 counties, there has been only one county-wide vote on establishing P.U.D.'s. Each vote in these counties was won by the P.U.D. Whether the companies which lost properties through these votes could try to regain them is not clear. It is clear that there has been but one vote wherever the P.U.D. won the first chance.

If the P.U.D.'s are to have second chances, should the companies they oppose enjoy them also? Admittedly the second chance a P.U.D. gets to take over properties is very different from the second chance which 166 offers the companies. Still, P.U.D.'s do get their second chance. Yet, in acquisitions, a company can only lose once, whereas a public agency need win only once. Acquisition by public agency generally ends things, just as a hanging ends a murder case. This minimizes the disparity between the second chances which P.U.D.'s cherish for themselves but seek to deny the companies.

Prevents Low Estimates

Under 166, opponents argue, P.U.D.'s would have to determine their bond issues in the abstract, get a supporting vote, then present it to the company or a condemnation jury. This, they say, is ridiculous, and pegs the price at the amount authorized for the bond issue. They say it induces a negotiating company not to take less, a condemnation jury not to award less.

But the suggestion that the P.U.D. first establish its price by negotiation or condemnation, then submit it to a vote, is opposed because this gives the companies a second chance.

Company people say that 166 would prevent P.U.D. supporters from underestimating acquisition costs for strategic purposes, winning support thereby for their low estimates, then acquiring the properties at a cost much above that the public had been led to expect. They say this happened in Benton County. Krug told ELECTRICAL WORLD he knew of no such cases, but conceded there might have been some. Such a practice, he says, was not used in similar acquisitions by TVA, and is generally prevented by the fact that P.U.D. commissioners must face their constituents and account for their actions. Krug's answer is logical, but does it provide as complete protection as a vote on a bond issue would? A vote upon a bond issue before it happens seems a better safeguard of public funds than does a vote against a man whose zeal for public ownership has led him to pay a price that would be too high to be acceptable to the voters.

Another Dodge

Opponents of 166 term it just another dodge to salvage companies who lose the first vote. They insist that if a company lost a vote on a bond issue, it would find a new dodge to get a third chance. To the contrary, says the president of a company involved, who adds that "we don't want to continue in business if the public wants a P.U.D."

Opponents of 166 say much of the disputed territory has already demonstrated, by voting to establish P.U.D.'s, that it wants the companies to go. Company people say many of these votes are too old to be longer indicative of public sentiment.

President Frank McLaughlin, of Puget Sound, sale of whose property to a group of P.U.D.'s is pending, says 166 misses the point—elimination of the tax differential between public and private power. He denies that his opposition is based on the effect 166 would have on his transaction.

What the voters must decide is whether the finality of acquisition, the sums involved, and the possibilities of misuse of public funds are of sufficient consequence to warrant the second chance.

How fair is a pistol duel in which the rules allow only one shot to one man while giving to the other as many as are needed to bring his opponent down?

NEWS OF THE WEEK

Pittsburgh Strike Ends When Union Agrees to Arbitration

Duquesne Light Supervisory Employees Kept Plants on Line during 27-Day Walkout—Loads Quickly Approach Normal as Workers Return—Arbitration Proceedings May Take 6 Weeks

PITTSBURGH'S power strike ended this week as its 27th day drew to a close.

After almost four weeks in which the union had failed completely to stop all electric service by the Duquesne Light Co., with less than two-thirds of the membership voting, striking members of the Independent Union agreed on October 20 to accept what their President George L. Mueller had agreed to accept just 38 days earlier—arbitration of all issues in the 35-point contract demand.

The end came swiftly after Mueller travelled to Washington and conferred with Labor Secretary Lewis B. Schwellenbach. Reported to have "invited himself" for the conference, Mueller returned to Pittsburgh last week-end and told reporters that he had received, in Washington, "strong indication" that National Wage Stabilization policies would be junked by November 1. Earlier, the union had rejected arbitration several times, ostensibly because its membership feared that it would be unable to win wage increases through it because of a conflict with National Wage Stabilization policy.

The company had insisted that any articles of arbitration permit the presentation of evidence as to the effect of additional wage boosts upon National Wage Stabilization policy. In last spring's arbitration, following a 19.5-hour strike in February, wage increases exceeding the amount allowable under wage stabilization by two cents per hour for seven of nine bargaining units were awarded by arbitrators and paid by the company.

It was learned in Washington that, following Mueller's visit to Schwellenbach, the Labor Department notified the Wage Stabilization Board that it had not told Mueller anything regarding the continuance or discontinuance of National Wage Stabilization. Additionally, it was pointed out that wage stabilization would affect any wage increase only if the company were to seek increased rates as a result of such wage increases. On this point, the company has not taken any public position.

The strike did not end without one additional attempt at sabotage—the fourth reported by the company and the least successful. On October 19, company officials said, a chain was thrown over a 22-kv. feeder out of Pine Creek. The line, serving industrial customers primarily and rendering emergency service to two municipalities, went out momentarily when breakers tripped open. They were closed quickly and service restored immediately without damage to any facilities, even though the chain, burned in two, remained hanging in the air.

On October 22, the union and Duquesne signed articles of arbitration providing that all issues over which the strike was waged would be arbitrated by a three-man board consisting of representatives chosen by the union, company, and the Secretary of Labor. Maurice R. Scharf, a New York consulting engineer who represented the company similarly last spring, was designated by the company. Both Mueller and Schwellenbach are to name theirs by October 29. Hearings are to begin not later than four weeks after October 22, and a decision is to be rendered not later than two weeks from the close of the hearings. Findings are to be final and binding, and interpretations thereof are to be submitted to the arbitration panel within five days after they are raised by either party. Each party is to pay the expenses of its arbitrator, and an agreed amount for the

HONORARY MEMBER—Irving E. Moultrop, left, consulting engineer of Belmont, Mass., and retired chief engineer of the Boston Edison Co., receives honorary membership in the American Society of Mechanical Engineers at the recent Boston convention, for his pioneer work in the field of high-pressure steam at the Edgar station and for his contributions to national engineering society work. In the center is L. W. Wallace, vice-president of A.S.M.E., and President D. Robert Yarnall is at the right

third will be split equally by the two parties.

The union's vote to accept arbitration came at a Sunday afternoon meeting which Mueller addressed for half an hour, without favoring or opposing arbitration. The vote to accept, counted by Allegheny County Sheriff Walter C. Monaghan, was 1,197 to 797. Immediately after the announcement, Duquesne President Pressly McCance broadcast a request for employees of the 3 p.m. and 11 p.m. shifts to report for work immediately, and other employees to report at their regular times. A good turnout was reported that night, and on Monday morning, the situation was about normal. Peak load Monday was about 400,000 kw., well under the Monday normal peak of about 525,000 kw. Company spokesmen attributed this to the inability of certain large industrial consumers to begin operations immediately. The Tuesday morning peak was 515,000 kw. as opposed to a normal Tuesday morning peak of about 575,000 kw.

As this issue of ELECTRICAL WORLD went to press, no estimates of the cost of the strike were to be had from company spokesmen. It was believed that newspaper estimates of a total cost in Duquesne's service area of $300,000,000 to $500,000,000 were excessive.

Office Operation Month Behind

The office force returned to an imposing amount of work, included in which is the processing and mailing of about 365,000 electric bills, 190,000 gas bills, and several hundred steam-heating bills. Other office operations were about a month behind, a spokesman said.

Believed to be the longest electric utility strike on record, the Duquesne strike was two and one-half times as long as the strike which tied up Los Angeles from February 14 to February 24, 1944. Despite its greater length, the Pittsburgh strike at no time was as disastrous to residential users, however, for the Los Angeles strike was complicated by a severe storm which disrupted the distribution system and cut off both industrial and residential service to thousands of users.

It was not known to what extent the striking independent union attempted to win sympathy action on the part of organized employees of systems interconnected with Duquesne. Whatever these efforts, they were of no value, for the interconnections were not deenergized at any time. The substantial imports they afforded, plus the company's own generation, kept service going at 25 to 50 percent of normal, with occasional peaks rising noticeably above the 50 percent level.

As far as could be determined this week, the strike peak was 278,000 kw., which was attained at 7 p.m., October 14, although somewhat higher levels may have been attained at intervals between the hourly load figures which were made available throughout the strike.

Hourly load figures, in thousands of kilowatts, for the final five days of the strike, are as follows:

Time	Oct. 16	17	18	19	20
7 A.M.	178	168	190	175	137
8	188	190	199	178	137
9	212	207	219	198	156
10	218	212	223	208	163
11	222	215	237	209	166
Noon	209	201	224	208	172
1 P.M.	213	212	233	208	185
2	216	217	228	206	192
3	216	220	241	197	202
4	210	229	239	192	202
5	201	219	254	199	212
6	234	257	253	254	243
7	257	268	268	263	strike
8	246	257	257	260	over
9	234	...	242	243	...
10	222	...	231	222	...
11	201	...	212	210	...
12	191	...	200	190	...

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Los Angeles Raises Pay

The Los Angeles Water & Power Board commissioners have voted to increase wages of the city's 7,200 utility workers. The raise was given unexpectedly after a survey was made showing that the cost of living had risen 9.4 percent since an advance in pay was given employees last July. Estimates are that the new scale will cost the city $84,000 monthly.

Employees receiving $300 or less per month will be raised 10 percent. Employees above the $300 bracket will get a 10 percent boost on their first $300 and 5 percent on the remainder.

Conciliation Service Asks Voluntary Curb on Strikes

An agreement binding unions in electric utilities not to strike without first trying to invoke the use of voluntary arbitration or fact finding is being sought by the U. S. Conciliation Service.

The immediate objective of such a pact would be to reduce the possibility of more strikes like that just ended against Pittsburgh's Duquesne Light Co. The long-range aim, however, is to establish some voluntary arrangement, such as this would provide, which could be used to ward off passage of any restrictive strike-control legislation which the 80th Congress is almost certain to consider.

Secretary Schwellenbach himself warned George L. Mueller, president of the Independent Union at Duquesne, that if the union did not accept the company's offer to arbitrate, Congress might be inspired to curb the rights of utility workers to strike.

The Conciliation Service is reported to have an unofficial understanding from the International Brotherhood of Electrical Workers, A.F.L., that it would consider going along on such an arrangement under the proper circumstances. The Utility Workers Union, C.I.O., have not yet been sounded out on the proposition. A problem is posed by the scattered independent unions, such as Duquesne's, most of which are unaffiliated and from whom it would be almost impossible to get a general commitment.

Agreement by the unions to such a limitation on their right to strike—and the odds are they won't agree—would mean a break from their basic opposition to any infringement whatever on the strike weapon. Such an agreement would indicate, also, a recognition by the unions of the possibility that Congress may pass restrictive legislation, and that it would be better for them to agree voluntarily to some curbs whose limits they have a hand in fixing.

N. Y. State Utility Council Has Organization Meeting

Nearly 100 executives of electric and gas companies in New York State met at Saranac on September 27 and 28 to hear discussions of various problems confronting the two industries. At the conclusion it was decided to call the group the New York State Utility Council and to meet informally from time to time. Robert E. Ginna, vice-president of the Rochester Gas & Electric Corp., was designated as chairman for the coming year with instructions to call a meeting when it was deemed necessary.

The sponsoring committee for the meeting was composed of Ernest R. Acker, president, Central Hudson Gas & Electric Corp.; E. F. Barrett, president, Long Island Lighting Co.; Robert E. Ginna, vice-president, Rochester Gas & Electric Corp.; John Haley, president, Central New York Power Corp.; R. D. Jennison, president, New York State Electric & Gas Corp.; B. G. Neilson, vice-president, Brooklyn Union Gas Co.; A. T. O'Neill, president, Buffalo Niagara Electric Corp.; Otto Snyder, president, New York Power & Light Corp.

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Approve Utility Franchises

Oklahoma Gas & Electric Co. has announced that voters in two Oklahoma towns, Gore and Webber Falls, have approved renewal of the company's franchises for 25 years.

Public Works Construction Curtailment Program Fades

Budget Bureau Authorizes $40,000,000 for Army Engineers for Flood Control Program—Reclamation Gets $25,000,000 Additional—Other Agencies Seek Funds to Continue Works

AUTHORIZATION by the Bureau of the Budget last week of additional expenditures by the Army's Corps of Engineers for flood control projects marked the first break in President Truman's program for curtailment of federal public works construction.

The Budget Bureau action permitted the Engineers to spend $35,000,000 during the current fiscal year for flood control work already under way. This amount was in addition to the $95,000,000 figure set by the President last August as the ceiling for such construction this year.

The Budget Bureau on Wednesday authorized the Bureau of Reclamation to spend an additional $25,000,000 for construction this year, bringing expenditures for Reclamation to a total of $110,000,000 for the fiscal year.

Spokesmen for the War Department and the Budget Bureau indicated that they expected still another authorization of $5,000,000 for new flood control work. Such an increase, plus that approved last week for the going projects, would increase flood control expenditures during the fiscal year to $135,000,000.

Budget Director James E. Webb said that the increase for flood control was necessary to prevent cancellation of contracts already awarded by the Engineers and a serious disruption of projects now under way. He added that the upward revision was not made on a project-by-project basis and that the War Department will decide exactly where the increased funds will be used. The expected increase for new projects will be applied to work approved by the Office of War Mobilization and Reconversion as "urgent and non-deferrable."

The Engineers have not yet released a list of either new or going projects affected.

The Bureau of Reclamation, which has been instructed to hold construction to $85,000,000 for the fiscal year, also has protested to the Budget Bureau that it would not be able to continue projects which it deems urgent under that limitation.

Both Reclamation and the Engineers are interpreting their expenditure ceilings as applying only to actual construction and are not including in their spending estimates the costs of preliminary surveys and investigations, land acquisitions, and other activities not involving the use of construction materials.

OWMR, which with the Budget Bureau was charged by the President with reviewing and scaling down federal works programs, last Saturday approved construction with a put-in-place value of $1,200,000,000 for 14 agencies. Individual agency authorizations were not announced.

Budget Bureau spokesmen pointed out that the OWMR authorization could not be compared with the $900,000,000 limitation on public works spending during fiscal year ordered by the President. The $1,200,000,000 figure, they said, represented the value of completed projects, many of which will not be finished this year, rather than expenditures before June 30, 1947. Further, the projects cleared by OWMR include some which will be financed in part by state and local funds, these funds being included in the program total.

The Budget and OWMR announcements had the effect of terminating the President's order freezing federal works construction, in effect since August 6. All agencies having construction programs, except the Commerce Department, now have lists of projects passed upon by reviewing agencies and may carry out construction on the basis of limitations set by either OWMR or the Budget Bureau.

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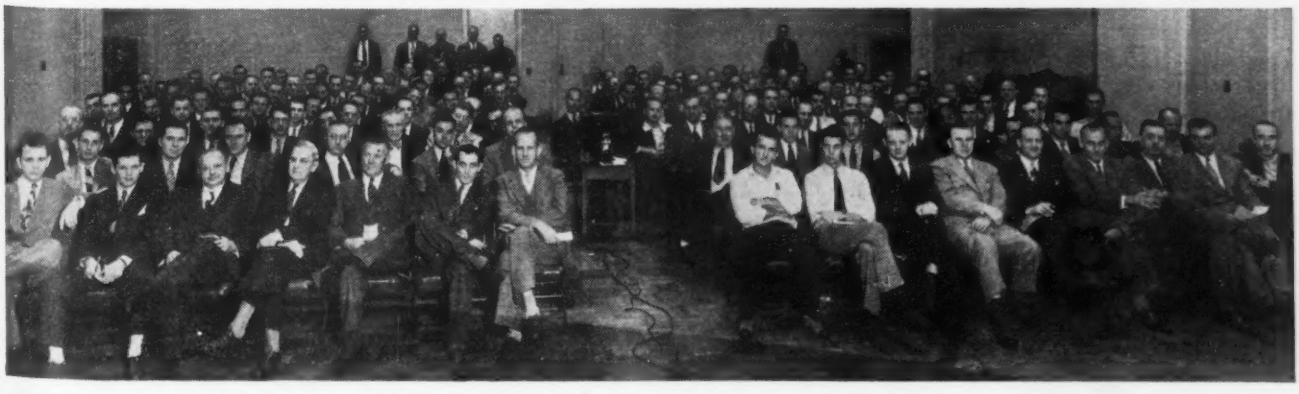
Operating Revenues Rise 5.6 Percent in August

Electric operating revenues of the larger privately owned electric utilities in the United States in August, 1946, were $274,307,000, as compared to $259,848,000 in August, 1945, an increase of 5.6 percent, according to figures released by the Federal Power Commission.

Revenue deductions (including operating expenses, depreciation and taxes) were $211,657,000 or 4.9 percent over those of August, 1945.

Gross income, including other utility operating income, increased 3.7 percent to $67,450,000 and net income in August, 1946, was $46,363,000, an increase of 17.5 percent from the net for August, 1945.



PAYING TO LEARN—Proving the lively interest of electrical dealers and contractors in the profit of potentialities of modern lighting is this first session of the "Planned Illumination" school now being conducted by the Electrical Association of Detroit under the direction of C. E. Munroe, chairman of its Lighting Education Committee. Less than 100 were expected, but 161 persons appeared for the course, whose cost is $3.50 for members and $5 for non-members

VEPCO Strike Avoided by Union for year

Threat of a power strike which would have affected most of Virginia was eliminated early this week when the Virginia Electric & Power Co. agreed to recognize for one year an International Brotherhood of Electrical Workers unit which has been seeking bargaining rights for 180 VEPCO foremen. As a result, the union recalled a strike notice filed some time ago.

The agreement was designed to afford a bargaining basis until the courts have ruled on the question of whether and to what extent unions may represent foremen. It was reached after conferences with Gov. William Tuck, who settled a threatened strike last spring by drafting workers into the State Guard and furloughing them to their jobs.

Will Negotiate Contract

Under the agreement, VEPCO will negotiate with I.B.E.W. a one-year contract on wages, hours, and working conditions of the foremen covered by the unit.

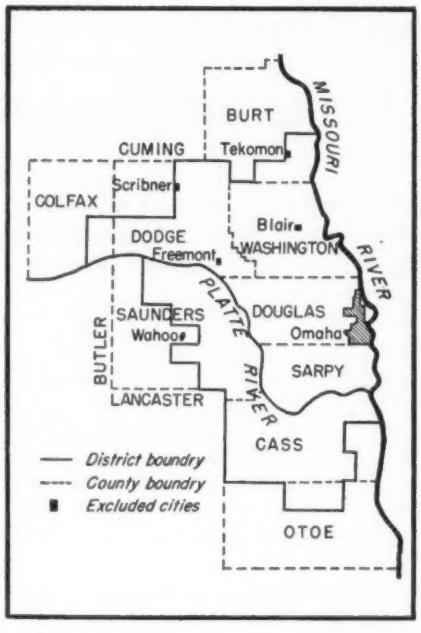
The dispute arose when VEPCO refused to agree to have its foremen represented by the same union which represents the rank and file workers of the system. Thereafter, I.B.E.W. filed a 30-day strike notice, whereupon Governor Tuck intervened.

A statement released by the State Labor Commissioner noted that judicial determination of the questions on foremen's representation may be had within a year.

2 Foremen's Cases in Dispute

Presently, two cases involving the collective bargaining rights of foremen are in process. One, involving the Packard Co., has been decided by a U. S. Circuit Court of Appeals, which ruled that foremen might be represented by an independent union unaffiliated with a union representing rank and file workers. No appeal has yet been taken to the Supreme Court, although one is expected.

The other case is now in the National Labor Relations Board, which certified the United Mine Workers of America as bargaining agent for rank and file employees and foremen of two captive coal mines of the Jones & Laughlin Steel Co. Since the certification, U.M.W. claims that J. & L. has refused to bargain with it regarding the foremen, a complaint which has been upheld to the extent of an intermediate report by NLRB, even though no order has yet been issued on the charge. It is believed likely that any such order would be appealed for a court ruling on the validity of the point.



OMAHA P.P.D.—Territory included in the Omaha Public Power District which has purchased the Nebraska properties of the Nebraska Power Co.

Nebraska Power Co. Sold to Omaha Power District

Omaha Public Power District directors have signed a contract to buy the Nebraska Power Co. from the Omaha Electric Committee. The purchasers will take title December 2 after financing is arranged and other details worked out. The purchase agreement has been on file with the Department of Public Roads and Irrigation for the required 30 days, and no objections to it were filed.

The agreed price is $43,747,530. When the district has completed the compulsory sale of its Iowa properties and current net assets are deducted, the net cost of the Nebraska properties will be approximately $37,747,530.

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Peak Load Records Set

Major electric utility system peak loads for August, 1946, reached a new record maximum of 38,366,000 kw., topping the previous high of 38,252,630 kw. set in January, 1945, the Federal Power Commission has announced on the basis of its preliminary figures. The August, 1946, peak was 2.6 percent higher than that of January, 1945, for the entire United States. In the West Central region, peak loads were up 4.6 percent; and in only two regions were they below, minus 1.2 percent in the South Central region and minus 0.4 percent in the Northwest region.

Utility Construction Rates High on CPA Approvals

Electric utilities have undertaken a major portion of the current industrial construction boom which Civilian Production Administration officials term the greatest in peace-time history.

A recent survey of CPA's records show that in the period March 26 to September 26 that agency approved some 52,000 applications for industry building at a total cost of nearly $2,000,000,000. A list of major projects authorized in this period reveals that ten private electric companies and one municipal utility had been given the go-ahead signal for new power plants or plant additions valued at more than $500,000 each.

A list of these major utility programs, showing the estimated cost in thousands of dollars of building and equipment to be installed where available, follows:

Utility	Bldg. Cost	Equip. Cost	Total
Potomac Edison Co.	$800	$3,200	$4,000
Scranton Electric Co.	789	3,300	4,098
Virginia Elec. & Power Co.	750	2,093	2,843
Duke Power Co.	774	3 948	4,722
Penna. Power & Lt. Co.	7,194	15,329	22,523
Consol. of Baltimore	2,000	5,200	7,200
Consumers Power Co.	1,000	3,000	4,000
Consumers Power Co.	3,500	7,000	10,500
Public Service Elec. & Gas Co.	....	....	1,750
Central Illinois Light Co.	....	....	1,070
Long Island Lighting Co.	....	....	3,875
Frankfort (Ind.) Light & Power Dept.	....	....	672
Total value all projects			$67,253

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Municipal Raises Pay

To avert a threatened mass resignation by the entire city electrical staff, Kelowna, B. C., has signed a new contract with the International Brotherhood of Electrical Workers, A. F. L., granting the following pay increases: foreman of the municipal plant from $165 to $215 a month, subforemen from 85 cents to $1.05 an hour, linemen from 80 cents to $1 an hour, metermen from $125 to $155 a month, groundmen approximately ten cents more an hour.

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Municipal Adds Capacity

Hydroelectric power was increased nearly a fourth for Idaho Falls, Idaho, municipal patrons when the switch of the new $110,000 generating unit at the lower plant on the Snake River was flipped September 10.

The addition to the power system increased the capacity at the lower plant from 1,500 to 3,000 kw. and of the municipal system from 7,000 to 8,500 kw.

Columbia Valley Authority Gets Endorsement of Krug

TVA-Type Authority for Pacific Northwest Boosted in 'Idea, Principles, and Objectives' by Interior Secretary in Talk before Public Ownership League of Washington at Seattle

SECRETARY of Interior Julius A. Krug announced October 12 that he favored "the idea, principle, and objectives of a regional Columbia Valley development body."

He thereby terminated speculation, which has prevailed since his appointment to the Interior post early this year, as to the future policies of his department in regard to TVA-type river development—insofar, at least, as such projects have been suggested for the Pacific Northwest. However, this sponsorship of the Valley Authority plan for that area, asserted in a speech before the Public Ownership League of Washington at Seattle, included no hint as to his viewpoints on the development of other river basins.

Objectives of Bill Essential

Commenting upon the Columbia Valley Authority bill presented during the last session of Congress by Senator Hugh Mitchell, Washington Democrat, Krug said:

"The idea of that bill was sound, the principles were right, the objective was not only desirable, but—in my opinion—essential to the rapid development of this region."

He took no stand on the details of the Mitchell Bill or any other CVA proposals, declaring that the provisions of such legislation were a matter for the Congress to work out in cooperation with legislators from the Columbia basin area who were "familiar with local problems."

Krug emphasized his belief that the proposed regional authority should take over the federal government's developments dealing specifically with irrigation, flood control, navigation, power, and recreation. Federal agencies conducting other activities in the region should not be affected in any way, he added.

He pointed out that the federal government has spent hundreds of millions of dollars, most of them disbursed by the Interior Department, to develop land, water, and power in Washington, Oregon, Idaho and Montana. A good job has been done in the federal development program, he contended, but the Interior Department has been seeking "the most effective government machinery for discharging federal functions." One of his first jobs as secretary, he added, was to make a study along these lines in regard to the Columbia River development program.

Soon after he became Interior Secretary, Krug visited the Columbia River basin and other regions in which the department was engaged on development projects. He consulted during this trip with groups supporting and opposed to the CVA plan. Some months later he dispatched two aides to the area to sample public opinion on the proposal.

His studies revealed "a number of misconceptions" which had arisen concerning a regional development body. He dealt with six of these in his Seattle speech. They were:

1. The belief that such a body would increase federal powers in the region. Actually, he declared, the regional authority would accomplish decentralization of certain major federal activities, concentrating existing federal authority in the hands of a local agency.

2. Fears that CVA legislation would create a "super federal government." The proposal, Krug stated, would not give the federal government "an iota of authority which it does not now have."

3. Contentions that other federal agencies would be replaced by the CVA. Such general national programs as those conducted by the Rural Electrification Administration, the Agricultural Extension Service, and Interior's forest and park services would continue under those agencies.

4. Irrigationists' worries over the interference with their water rights by such a body. The Regional Authority would protect the rights of existing water users "with more force and less delay" than now is possible.

5. Fears of the same group that power would displace irrigation as the prime responsibility of the federal government. With more effective government machinery for power production and disposal, facilities for pumping and distributing water would be improved, Krug asserted.

6. Regarding the state's rights issue, state authority would be strengthened by placing the federal administrative group alongside state administrators so that the two could work cooperatively. Krug also quoted recent statements by the governors of Mississippi, Georgia and Kentucky to the effect that TVA had not encroached upon the authority of their states.

"The only honest complaint I've heard about setting up an authority in the Columbia Valley region is that it would spread low-cost public power more rapidly and more widely, would develop the land and mineral resources

NAMES HEAT PUMP—L. J. Endicott, load dispatcher of Georgia Power Co., receives $100 war bond from William E. Wood, left, executive vice-president of Virginia Electric & Power Co. and president of the Southeastern Electric Exchange, for submitting "Climator" as the most appropriate name for the heat pump. W. E. Mitchell, president of Georgia Power, is at the right. The award was made at the recent meeting of an Exchange committee

of the area more quickly and fully, and would with greater success provide the economic basis for a substantial increase in population and standard of living," Krug said. "There are some people who honestly don't think anyone else has."

The Krug endorsement of a CVA, though its timing occasioned some surprise in Washington circles, had not been entirely unexpected. Just a few weeks ago the Bonneville Power Administration took over from the Bureau of Reclamation the "planning, development and marketing" of Federal power in southern Idaho. This move, reportedly ordered by Krug, followed the recent assumption of similar duties by BPA in northern Idaho and in Montana. The objective of these shifts, according to an Interior announcement, was to bring about the integral development of the Columbia and its tributary streams by a single agency.

Political observers noted that the Seattle speech came in the midst of Senator Mitchell's campaign for reelection. The CVA bill was the most important piece of local legislation introduced by Mitchell during the last Congressional session.

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Detroit Edison Expansion Plan Totals $20,275,000

Detroit Edison Co. has a $20,275,000 construction and expansion program underway including the addition of a 100,000-hp. unit to its Marysville plant, south of Port Huron, which is to go on the line next spring.

Additional projects include cinder catching equipment at two Detroit plants, eleven substations, the reconstruction of overhead lines in the downtown section of the city to take care of increased load, and the extension of the a.c. network to supplement the d.c. system.

The company has already made service available to 95 percent of the farms in its territory and will build 400 miles of lines in order to attain 100 percent coverage. One-half of the total is to be constructed this year.

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Samuel Ferguson Resigns

Samuel Ferguson has resigned the presidency of the Hartford Electric Light Co. but will continue as chairman of the board. His successor will be Austin D. Barney, vice-president and general counsel. Vice-President and General Manager Kenneth P. Applegate has been promoted to executive vice-president.

Utilities Get Top Priority for War-Time Installations

Electric utility companies may qualify as top priority bidders for power equipment from war-time military installations as a result of a directive issued late last week by the National Housing Agency.

The NHA order called on federal disposal agencies to offer utility equipment, as well as buildings, at such installations for sale intact to the highest bidder who certifies that he will use the materials in connection with veterans' housing. These instructions, when put in effect by the disposal agencies, would supersede the former practice of extending priorities on sales of surplus materials of this type to federal bureaus, state and local governments, and non-profit institutions.

NHA officials said that the objective of the order is to speed procurement of surplus property needed for home construction and channel it into the Veterans Housing Program. Power, gas, and water facilities above and below ground at surplus installations could, under the terms of the order, be sold to utilities or contractors who would reclaim the materials for use in veterans' housing, they said.

The directive provided a form certificate suggested for use by disposal agencies in establishing priorities for bidders. The form would require each bidder to guarantee the use of purchased surplus for:

(1.) Construction of housing accommodations for which HH ratings have been authorized under the Veterans Housing Program, or (2.) construction or maintenance of utilities necessary to service priority housing.

Agencies whch are handling the disposal of surplus military installations, in addition to WAA, include the Navy's District Public Works Offices, War Department's Division Engineers, the Farm Credit Administration, and Interior Department's Office of Land Management. WAA is reported studying the directive. Other disposal agencies have indicated that they will comply with the order in the near future.

NHA and WAA have abandoned their program of ordering the dismantling of military installations. Under that program the Army's Engineers have undertaken the dismantling of 19 installations, and these activities will be continued. More than 200 more installations are still to be disposed of, however.

Instructions on how equipment may be obtained under the NHA directive have been sent to builders, contractors and HH priority holders, housing officials said.

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Rural Loans Granted

The Rural Electrification Administration in September announced loans totalling $18,533,500 to 51 cooperatives and two public utility districts in 22 states. Most of the loans were for the construction of lines, of which 9,080 miles are to be built to serve 26,239 customers. A small amount of the loans was for the construction of substation and generation facilities.

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Last Unit Installed

The last of five 42,000-hp. generators to be installed at Kentucky Dam, Gilbertsville, Ky., the last link in the Tennessee Valley Authority system, has been installed by General Electric Co.

MEETINGS

Previously Listed

RLM Standards Institute—Annual meeting, Brighton Hotel, Atlantic City, N. J., October 28.

International Association of Electrical Inspectors—Eastern Section, Mark Twain Hotel, Elmira, N. Y., October 28-30.

National Electrical Manufacturers Association—Annual meeting, Traymore Hotel, Atlantic City, N. J., October 28-November 1.

Missouri Valley Electric Association—Rural Roundtable Discussion, Hotel Continental, Kansas City, Mo., October 29; Fall sales and rural conference, Hotel Continental, Kansas City, Mo., October 30-31.

Edison Electric Institute—Accident prevention committee, Hotel Statler, Buffalo, N. Y., October 31-November 1.

Southeastern Electric Exchange—Commercial Section, Atlanta Biltmore Hotel, Atlanta, Ga., November 6-9.

California Municipal Utilities Association—Annual meeting, Glenwood Mission Inn, Riverside Calif., November 7-8.

Pennsylvania Electric Association—Meter committee Benjamin Franklin Hotel, Philadelphia, Pa., November 7-8; Systems operation committee, Skytop Lodge, Pa., November 7-8; Communication committee, Benjamin Franklin Hotel, Philadelphia, November 14-15.

National Farm Electrification Conference—Sherman Hotel, Chicago, Ill., November 7-8.

National Research Council—Conference on Electrical Insulation, Johns-Hopkins University, Baltimore, Md., November 7-9.

National Association of Railroad and Utilities Commissioners — Annual meeting, Biltmore Hotel, Los Angeles, November 12-15.

American Welding Society—Annual meeting, Ambassador Hotel, Atlantic City, N. J., November 17-22.

New Jersey Utilities Association—Annual meeting, Seaview Country Club, Absecon, N. J., November 22-23.

National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, N. Y., December 2-7.

SEC RULINGS

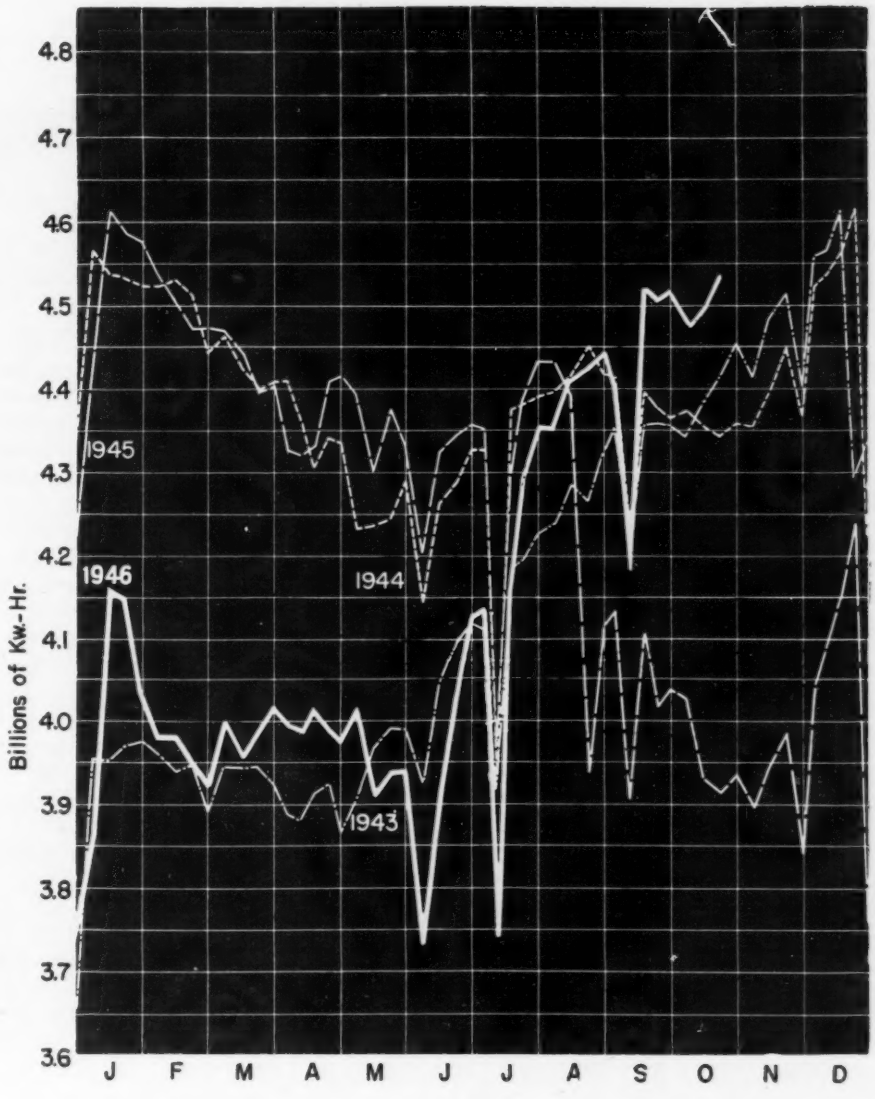
The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

ELECTRIC BOND & SHARE CO. will acquire by transfer securities of four of its subsidiary companies now held in the name of designated nominees. Elimination of nominee holdings is necessary, the SEC stated, to complete simplification and geographic integration of Electric Bond & Share. The commission also authorized the issuance of new certificates in the name of Bond & Share for the securities of the four companies; American & Foreign Power Co., Inc.; American Gas & Electric Co.; American Power & Light Co., and Electric Power & Light Corp. (Release No. 6926).

COMMONWEALTH & SOUTHERN CORP.'s application requesting authority to expend at its discretion not more than $5,000,000 to purchase in the open market, or otherwise, shares of its outstanding $6 cumulative preferred stock has been approved. The commission ruled that the minimum purchase price to be paid by Commonwealth for the preferred shares shall be $1 a share below the closing market price of $118 on the New York Stock Exchange on October 4. It was also stipulated by the commission that at least seven days before Commonwealth begins to purchase preferred shares it shall advise by letter each holder of record of its preferred fully with respect to its intentions to make purchases and the method to be employed. The commission also ruled that during the time the acquisition program is in effect, Commonwealth shall not reduce the current dividend rate of twice preferred dividend requirements. Commonwealth shall not purchase its preferred stock knowingly, directly or indirectly, from any associate company, or any officer or director, or from any associate of any officer or director of Commonwealth or of any associate company. The commission stipulated further that all purchases of the stock must be effected on the New York Stock Exchange except that the company may purchase blocks of 500 shares or more otherwise than on the Exchange provided it notifies the commission of all details and the commission approves the purchase. The commission also ruled that no purchases shall be made after three months from the date of the present order. Commonwealth, however, has the right to apply for any extension of the period. (Release No. 6930).

NEW ENGLAND GAS & ELECTRIC ASSOCIATION has been granted an extension to November 30 on issuance of new bonds and common stock, as contemplated in its amended recapitalization plan. The program was approved by the commission on June 24. (Release No. 6925).

METROPOLITAN EDISON CO.'s proposal to merge the Edison Illuminating Co., Easton, Pa., into itself has been authorized. Metropolitan Edison, a subsidiary of the NY PA NJ Utilities Co., recently acquired all outstanding capital stock of Edison Illuminating. It will surrender these securities for cancellation at the time of the merger. (Release No. 6942).



Electric Output Curve Hits New '46 High

The electric output curve continued to move upward during the week ended October 19, 1946, according to figures released by the Edison Electric Institute, reaching a new high for this year.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,539,712,000 kw.-hr., compared with 4,495,220,000 kw.-hr. during the preceding week and with 3,914,738,000 kw.-hr. during the corresponding week of 1945, that of October 20. The previous high for 1946 was 4,521,151,000 kw.-hr. for the week ended September 14. The over-all percent change for the country as a whole for the week ended October 19 as compared with the corresponding week of 1945 was an increase of 16.0 percent. For the week ended October 12 the percent change amounted to 14.3 percent and for the first week in October 11.2 percent.

Four of the major geographical regions of the country reported higher increases over the preceding year than were shown for the week ended October 12; two reported smaller increases and one group, the Mid-Atlantic, remained unchanged.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Oct. 19	4,540	Oct. 20	3,915	Oct. 21	4,345
Oct. 12	4,495	Oct. 13	3,934	Oct. 14	4,355
Oct. 5	4,478	Oct. 6	4,028	Oct. 7	4,375
Sept. 28	4,518	Sept. 29	4,039	Sept. 30	4,366
Sept. 21	4,507	Sept. 22	4,019	Sept. 23	4,377
Sept. 14	4,521	Sept. 15	4,106	Sept. 16	4,395
Sept. 7	4,184	Sept. 8	3,909	Sept. 9	4,228
Aug. 31	4,404	Sept. 1	4,137	Sept. 2	4,415
Aug. 24	4,444	Aug. 25	4,116	Aug. 26	4,418
Aug. 17	4,422	Aug. 18	3,939	Aug. 19	4,451
Aug. 10	4,412	Aug. 11	4,395	Aug. 12	4,415
Aug. 3	4,351	Aug. 4	4,432	Aug. 5	4,399
July 27	4,352	July 28	4,435	July 29	4,391

Percent Change from Previous Year

	Oct. 19	Oct. 12	Oct. 5
New England	+10.9	+12.8	+ 9.9
Mid-Atlantic	+ 9.7	+ 9.7	+ 7.8
Central Industrial	+13.3	+10.1	+ 8.1
West Central	+14.7	+11.7	+ 9.3
Southern States	+28.4	+24.1	+19.5
Rocky Mountain	+ 7.4	+ 6.5	+ 4.3
Pacific Coast	+16.5	+17.7	+12.2
Total United States	+16.0	+14.3	+11.2

'Protect the Future' Theme Of NECA's Annual Meeting

Attendance Record Set at 45th Meeting—Leaders of Labor, Business, Government, and Industry on Program—Housing Problems Discussed—George Andrae Gets 1946 McGraw Medal

THE 45TH ANNUAL MEETING of the National Electrical Contractors Association was held at Atlantic City, October 14-18. It was the largest meeting in the history of the association, the registration totaling over 900 delegates and guests from all parts of the United States and Canada.

The theme of the convention was "Protect the Future." On the program were speakers from business, government, industry, and labor commenting on the future of the construction industry, with strong emphasis on housing.

In the keynote address, Robert W. McChesney, president of NECA, called for an immediate end of wage and price controls and the return of industry to a competitive basis. He stated that we must reestablish quickly the system of American free, private, competitive enterprise and recommended that the convention take decisive action to so indicate.

Objectives For Construction Industry

Addressing a luncheon meeting, Beardsley Ruml, chairman of the board of R. H. Macy & Co. and chairman of the Federal Reserve Bank of New York City, outlined three objectives for the construction industry in its struggle to handle the immense task of building up the American home and plant. The short-term objective is to house the veterans speedily and relieve the pressure for housing generally. The intermediate goal is to create a reasonable stability in the industry through advance planning of public works and conservation projects and through the skillful planning of optional projects. The long-term goal is to bring into the industry the fruits of technical and managerial knowledge, to raise the industry to its appropriate place in terms of productivity and efficiency, to reduce costs and prices and to increase annual earnings of workers, and to give a regular and reasonable margin of profit for successful enterprise.

A paper on labor-management cooperation, prepared for the convention by Dan W. Tracy, president-elect, I.B.E.W., Washington, was presented by Lawson Wimberly. Mr. Tracy outlined various sub-goals to be striven for as components of successful labor-management cooperation in the public interest. These include: (a) Ever-improving standards of construction, maintenance, and repair in the contracting field of the electrical industry, operation in the public utilities field, and production in the manufacturing field. (b) Education of the public in the manner and forms of such improvements together with the value thereof and the benefits to the public deriving therefrom as well as the long-range economies resulting. (c) Reduction to a minimum, if not total elimination of work stoppages, resulting from industrial disputes, whether in the form of strikes or lockouts. The sum of these components, Mr. Tracy said, is service and continued improvement of service in the interest of and to the benefit of the public, at a cost consistent with fair compensation to labor, just renumeration for management, and equitable return for investment.

Line Contractors Organize

The Line Construction Contractors Division of the I.B.E.W. Section of NECA was organized at a special meeting on October 17. The purpose of the Division is to provide electrical contractors specializing in line work a national medium with regional facilities through which they can express their collective voice and formulate activities for their own mutual benefit and protection.

The principal feature of the banquet was the presentation of the James H. McGraw Award Contractors Medal for 1946 to George Andrae, president of the Herman Andrae Electrical Co. of Milwaukee, Wis. Samuel B. Williams, editor of ELECTRICAL WORLD and secretary of the Committee of Awards, made the presentation. Mr. Andrae received this award for his outstanding contribution to the industry through his effective work on electrical codes, and by advocating reduction of waste through product simplification and improved standards for electrical equipment and materials and their installation.

Hearings on Iowa Co-op's Plea for FPC License End

Hearings on the petition of the First Iowa Hydro-Electric Cooperative for a license to construct a hydroelectric project on a diversion canal between the Cedar and Mississippi Rivers, near Muscatine, Iowa, have been concluded at Davenport, Iowa, where Glenn R. Law, examiner for the Federal Power Commission, presided.

November 4 has been set as the date for the co-op and the FPC staff to file briefs, and the State of Iowa was given until November 18 to file its reply brief. The briefs will be reviewed by the examiner, who will then make his recommendation to the power commission.

In its decision, FPC will rule on the power project's economic feasibility and adequacy of design; and even if the license is granted, other obstacles stand in the co-op's way. Greatest of these is the opposition of Iowa, whose representative at the hearing, Neill Garrett, special assistant to Attorney General John Rankin, said,

"The State of Iowa does not intend to allow construction of the project. It will use every means at its command to prevent destruction of the Cedar River by a private enterprise."

Other objectors were Muscatine County farmers whose land would be affected by the project; the Chicago, Rock Island & Pacific R. R. which would have to reconstruct a portion of its lines; and private utility companies.

The state's weapons against the project are taxation, an issue which is still in doubt, and control over the finances of the co-op. The state has argued that the sale of bonds to be used in financing the project cannot be authorized in Iowa.

The financial status of the co-op was attacked by the state during the hearing. F. W. Scheidenhelm, engineering consultant from New York, in testifying for the state, placed the cost of the project at $29,000,000, compared to estimates of about $18,000,000 by the co-op and of $22,000,000 by FPC engineers.

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P.P.D.'s to Build Plant

Loup River Public Power District, Platte Valley Public Power and Irrigation District, and the Central Nebraska (Tri-County) Public Power and Irrigation District are proceeding with plans to build a 60,000-kw. steam power plant at a cost of $10,000,000. The site will be at Bellevue, Sarpy County, about ten miles south of Omaha along the Missouri River.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Upright Mounting Solves 110-Kv. Fuse Replacement

D. L. GREENE
Consulting Engineer, Gilbert Associates, Inc., Reading, Pa.

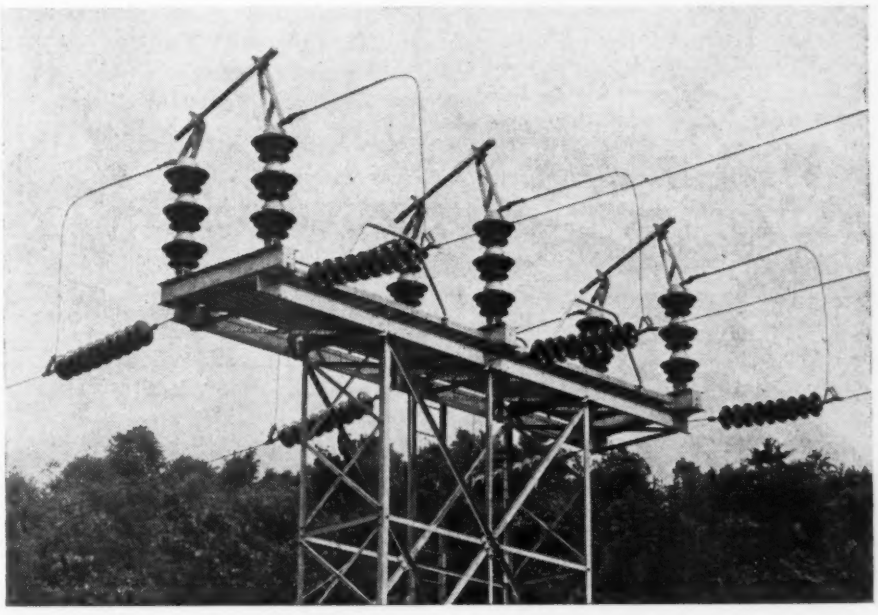
VERTICAL MOUNTING of high-voltage fuses requires the fuses to be located some distance from the ground to provide adequate clearance with the conductors that must necessarily be connected to the bottom of the fuse and be carried under the supporting numbers. This requirement usually results in the fuses being so high that it becomes difficult, if not impossible, to handle them from the ground by means of a switch stick or tongs. This is particularly true in ratings of 46 kv. and above.

It is then necessary to erect a platform, with a railing, on another structure in front of the fuses. The railing of the platform must be sufficiently clear of the conductors to provide adequate line-to-ground clearance which removes the platform beyond an operator's reach of the fuses. This requires the use of a 10- or 12-ft. switch stick or fuse puller, to open and remove the fuse.

Trying to handle a fuse holder weighing 60 lb. on the end of such a long stick is impracticable if not impossible, especially under the adverse weather conditions of rain, wind, ice, etc., that usually prevail when fuse replacement is necessary. Horizontal-inverted mounting of the fuse involves practically the same problems.

In the planning of a new 110/33-kv. substation on the Northern Pennsylvania Power Co.'s system at Lenox, Pa., the above difficulties were recognized and overcome by an arrangement that provides a safe and convenient method of renewing the 110-kv. fuses.

The substation was installed in a valley beneath the 110-kv. transmission line, at the approximate center of a 2,200-ft. span. Two 45-ft. high, Gilbert Associates standard towers were installed directly beneath and in line with the 110-kv. line. This facilitated the "cutting-in" of the substation by removing a short section of the line and dropping each end of the line a few feet to the towers.



PLATFORM facilitates replacement of 110-kv. fuses with circuit deenergized

Elpeco type 190 air-break switches with OB-31152 insulators were installed on these towers for line disconnects that will become bypass switches for the future oil circuit breakers.

The fuse installation consists of a Gilbert Associates No. 4A standard tower 32 ft. high with a top platform 21 ft. long by 4 ft. wide. A ladder was installed on the load side of the tower, to a steel grating platform on top of the tower between the bases of the fuse mountings. A railing was mounted along both sides of the platform, as long and as high as electrical clearance would permit, to safeguard the operator. The ladder terminates at one of the openings between the railing and fuse mounting and provides convenient access to the platform.

The fuses are Schweitzer & Conrad type BM mountings with type SMG holders and type SMI cartridges of refill units. Special adapters are mounted on the top of the O-B No. 31152 insulators to position the fuse holders approximately 20 degrees from horizontal which is necessary for proper fuse operation. This arrangement results in 5½-ft. distance between the center of the fuse holder and the channel base, which permits an operator to step on the base and with *both* hands remove the fuse holder from the clips. The clip at the high end is 6½ ft. from the base and can easily be reached to turn the locking device and release or tighten the fuse clips. After removing the

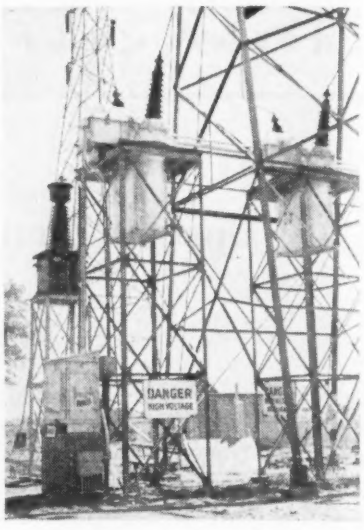
fuse holder it is placed on the platform where it is a simple matter to replace the blown cartridge with a new one.

Before attempting to change a fuse it is necessary to ground the circuit on each side of each fuse. After opening the 110-kv. air-break switch ahead of the fuse and the 33-kv. air-break switch on the secondary of the transformers a ground is placed on the 110-kv. bus at the transformer bushing terminal by the use of a step ladder and standard grounding sticks. With these in place, the operator proceeds to the fuse platform with a handline to which is tied three more ground sticks. These are raised to the platform and installed on the line side of the fuses, which effectively grounds both sides of the fuses or working area.

The handline is then looped around the two insulators of each outside fuse mounting to safeguard the operator at the ends of the platform. The fuses may then be renewed and contacts inspected by the operator with ease and safety.

Old Non-Reclosing Breaker Made Reclosing

WITH some of the older substations having non-reclosing breakers, occasion may arise where it is desired to provide reclosing mechanism. In such a case at an outlying P.G.&E. 110-kv. station, B. D. Dexter, substation engineer, solved the problem by using an old G. E. MK-4 centrifugal reclosing device on hand and obtaining operating power from a 500-va. potential transformer mounted as shown. The potential transformer has sufficient short-time overload capacity to supply the 48 amp. at 230 volts required for the flyball recloser. If the 110-kv. line goes dead, the breaker automatically recloses upon restoration of voltage on the potential transformer. Thus an important function was inexpensively performed.



OLD 110-kv. breaker is made automatic reclosing with centrifugal recloser supplied by potential transformer. Unusual height of breaker is because of flood conditions in the past

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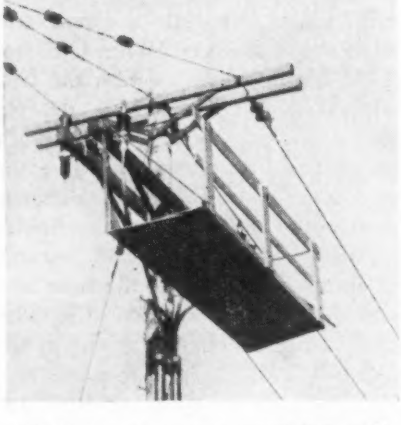
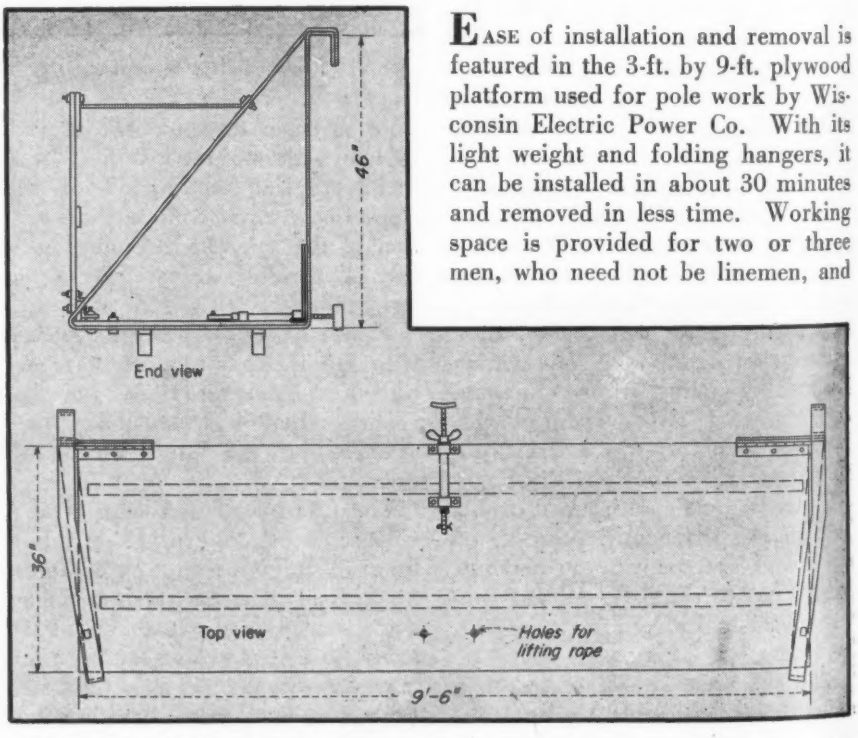
Platform Designed for Easy Mounting and Removal

R. L. DODD Assistant Superintendent, Electrical Construction, Wisconsin Electric Power Co., Milwaukee, Wis.



AMPLE work space provided with this light-weight folding platform

EASE of installation and removal is featured in the 3-ft. by 9-ft. plywood platform used for pole work by Wisconsin Electric Power Co. With its light weight and folding hangers, it can be installed in about 30 minutes and removed in less time. Working space is provided for two or three men, who need not be linemen, and



PLATFORM is hinged to fold up and brackets to swing in, giving a compact unit for hauling and mounting. A railing is raised separately and bolted to the brackets after the platform is in place. Top and end views shown

it is used extensively for installing potheads and lightning arresters.

Hangers are $\frac{3}{8}$ in. by $2\frac{1}{2}$ in., bent for crossarm mounting. An adjustable jack at the platform level fits against the pole to permit leveling by means of a wing-nut. The platform is of $\frac{3}{4}$-in. plywood with 2-in. by 4-in. tapered joists.

Platform and brackets are hinged to a steel plate at the lower end of the hangers. This permits the platform to be swung up against the hangers and the brackets may then be folded in against the platform.

Two holes in the outer edge of the platform (in the upper edge when folded) provide for a lifting rope to raise and lower the assembly to the crossarm mounting. A railing is mounted after the platform is up.

• • •

Develop Hoisting Plate for Insulator Assembly

THE OPERATION of dead-ending a conductor on a tower has been made easier by the use of a hoisting plate in the tension insulator assembly. When a tension assembly is being connected to the crossarm plate, difficulty is often experienced in attaching the clevis at the end of the assembly to the crossarm plate. The last one or two inches of the pull requires extended effort by the lineman to align the bolt of the clevis in the hole in the crossarm plate. The device was developed by F. H. Legge, an engineer in the Electric Distribution Department of Public Service Electric & Gas Co., Newark, N. J.

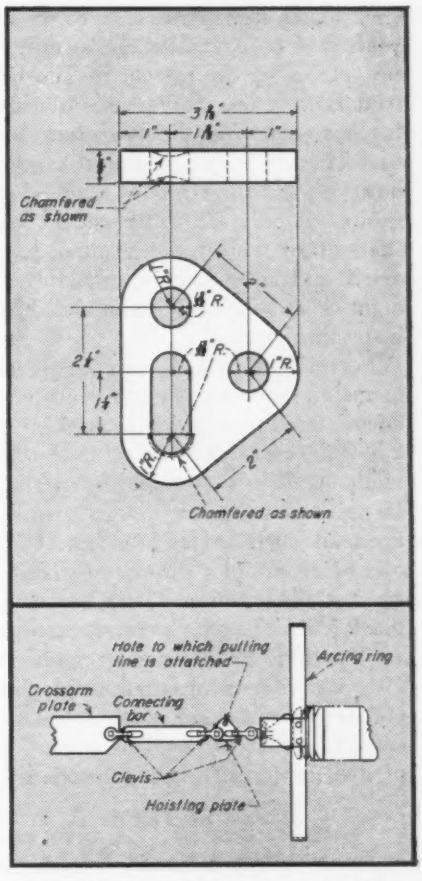
The hoisting plate is made from $\frac{5}{8}$-in. steel plate (A.S.T.M. Standard Specification for Bridges) and is triangular in form. Dimensions and a typical installation are shown in the accompanying illustration. One circular hole in the hoisting plate takes the bolt of the clevis at the end of the connecting bar. The slotted hole has a clevis inserted for connection to the tongue of the arcing ring. The clevis in the eye of the pulling line is attached in the third hole.

Tension on the pulling line, which runs through a block attached to the end of the crossarm, pulls the insulator assembly, which has been attached to the conductor on the ground, into position for connection to the tower.

The use of a dead-end chain for attaching the pulling line block to the tower crossarm is placed of necessity some distance from the hole in the crossarm plate. The connecting bar, about 12 in. long, provides the necessary reach for ease of attachment. After the clevis at the far end of the connecting bar is attached to the crossarm plate, tension in the pulling line is released and the clevis in the eye of the pulling line is detached from the hoisting plate, leaving the assembly in its proper position.

By attaching the pulling line to the tower end of the tension insulator assembly, all of the slack is pulled out of the insulators, which is especially helpful in the installation of double and triple string tension assemblies.

The size of the hoisting plate may be varied to meet conditions of strength required.



HOISTING PLATE for transmission line insulator assembly; outline (top) and a typical installation

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Cost of Adding 5,000-Kva. Transformer to Bank

FROM the field sheets of a power system which added a 5,000-kva., 69/23/11-kv. 3-phase transformer to a substation bank in 1945 it appears that the over-all cost of the equipment and installation, done in about three months, and including labor, engineering, and all associated expenses, was $14,503, or $2.90 per kva. Water cooling facilities ran up somewhat in connection with the piping for local layout. All items tabulated include material and labor, which were not separated in the record available, but are useful for estimate checking.

Cost of Adding 5,000-Kva. Transformer

(Cents Omitted)

One 3-phase, power transformer, 5,000 kva., 23 and 11 kv. sec., 69 kv. prim.	$7,327
Poles 1—40 ft., $33; 2—35 ft., $140	173
Guys, 5	104
Anchors, 5	47
No. 2/0 Stranded bare copper wire, 300 ft	449
Disc insulators, 6 strings, 2-unit	109
No. 4/0 solid copper ground wire	82
Ground, 1	481
Crossarms (wood) 8, each 7 ft. long	89
Pin type insulators, 3	14
Transformer cribbing	134
Control conduit, 40 ft. of ¾-in.	29
Control wire, No. 14, 100 ft.	23
Water piping	2,600
Gate valves, 3 3-in.	132
Insulated risers, 12 ft. of 2.5-in.	133
Strainer, sanitary assembly, rack, pump priming assembly	1,042
Internal connection	1,130
Pump, 1 —100 gpm	240
Miscellaneous items	165
Total cost	$14,503

Deterioration of Tower Galvanizing Checked Periodically

N. A. KERSTEIN
and
L. E. GIBSON
The Detroit Edison Co.
Detroit, Michigan

CORROSION of galvanized transmission tower legs in service 15 to 21 years has been significant in only a few places on the system of The Detroit Edison Co. Some cases of rusting have been found below ground in corrosive muck soil. On most towers, however, the thickness of zinc below ground is only 20 to 30 percent less than at or above the ground level and it did not change appreciably in eight years between the first and third inspections made.

Locations for the tests were selected to include extremes in soil conditions encountered throughout the system of 2,300 towers. The original tests were made in 1936 to supplement routine inspections by patrol linemen which are made at bi-yearly intervals. Only one of 29 samples showed significant rusting. This tower was in corrosive muck soil. The tests were repeated in 1938 with no further rusting noted. In 1943 the number of locations was increased to 35. Some rusting was observed on the below-ground portion of five towers in this examination.

Method of Testing

To obtain representative samples of the galvanizing for examination at periodic intervals, the short braces indicated in the accompanying illustration were chosen. These were the most suitable members because they show conditions above ground, at the ground level and below ground, and are easily replaced. Inasmuch as there are eight of them on each tower, it is possible to conduct eight consecutive destructive tests.

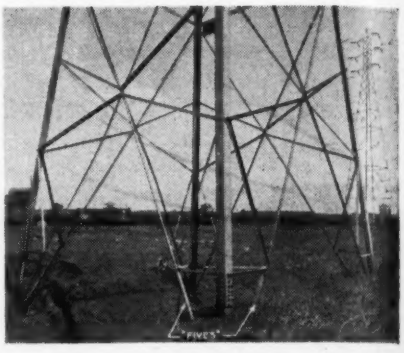
A record was made of the type of soil at each tower site for correlation with test results. A visual examination of the galvanizing on the tower members was also made during each investigation. The average thickness of galvanizing was determined on the sampling stock from each tower, with specimens cut from the three points, above, at and below ground level. Standard ASTM procedure was used in the test and computation of zinc present.

A white adherent surface layer of zinc salts was observed on many below-ground samples at the interface between the zinc and the soil. Despite the diminished thickness below ground, the amount of zinc on the metal exceeded in most cases the company's specification minimum of 2 oz. per sq. ft.

Preventive Maintenance Applied

Where significant corrosion has been noted, preventive maintenance has been applied. This has consisted in the application of protective coatings of plasticized bitumen below ground and applications of a lead-suboxide aluminum paint above ground on all structural members except those used for sampling stock.

On the occasion of the third inspection, no major rusting was in evidence on any part of the towers above ground except in industrial locations where the atmosphere was very conducive to corrosion. In these locations, or at any other location where minor rusting was observed at the time of the routine bi-yearly inspections by the ground patrol, protective paint was applied for the sake of both protection and appearance.



SAMPLES selected for test, designated as "fives," extend both above ground and below ground and are easily replaced short braces

The results of the inspections to date show that the towers are in good condition and that no serious corrosion exists. On an average, the amount of zinc lost over the last 5-yr. period has been less than was expected. With the maintenance and inspection program presently in force it is thought that the towers will last indefinitely above ground and for at least another 20 to 25 years below ground.

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Industrial Plant Combined Power and Light . . . III*

L. C. PETERMAN, Electrical Engineer, Ford, Bacon & Davis, Inc., New York, N. Y.

IN TWO PREVIOUS ARTICLES we covered methods (a), (b), and (c) for supplying light and power circuits in industrial plants.

Method (d) is the same as method (c) with respect to the power circuits, but the 4-wire, 265/460-volt circuits for lighting limit the light source to 2- or 4-tube 100-watt fluorescents, 400-watt mercury Type H or filament lamps. This design will develop generally a greater saving than method (c) in cases where these lighting units can be used. However, the four-unit, 100-watt fluorescent fixture can be used for general lighting only where mounting heights of 18 to 20 ft. or more are possible. For lower mounting, uniform illumination cannot be secured except at unusually high intensities. The mercury lamps have such a high intrinsic brightness that mounting heights under 30 to 40 ft. are objectionable. For these reasons, these light sources cannot be used for general illumination in many of the smaller and older plants where ceiling heights are often as low as 10 ft. with 12 or 14 ft. quite common.

Even where the 400-watt fluorescent and mercury luminaires can be used and 265/460 volts used for their supply, the transformers mentioned

* Concluding a three article series which began in ELECTRICAL WORLD, September 28, 1946, page 130.

under method (c) cannot be dispensed with entirely because of the need for 115 volts for extension cords, hand tools and many portable and semi-portable devices which are ordinarily operated at that voltage. Many plants have a duplex convenience outlet on practically every building column which requires a 115-volt system that is nearly as extensive as the 265-volt lighting system.

Although the 265/460-volt system for lighting has rather limited application, conditions vary so widely in various plants that it should be given careful consideration when planning a new installation.

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Leak Detector Used For Testing Gasketed Studs

SPECTROMETER facilitates testing for leaks in transformer cover

AN INSTRUMENT, known as a leak detector and normally used to locate leaks in a vacuum system, was recently used to "sniff" leaks in gasketed studs and thereby reduced the testing operation by one-third time. The novel application was made by General Electric Co. engineers working with the Consolidated Edison Co. of New York, when three large special transformer covers were replaced with new ones made of aluminum.

Each cover had 177 gasketed studs through the plate, and each stud had to be tested for oil-tightness. It was possible to use air pressure and a soap solution on each stud to detect leaks, but it would have been a long job and the soap solution might have penetrated under the head of some studs, ultimately contaminating the oil inside the transformer when the covers were finally installed.

The leak detector is based on a design of the mass spectrometer. Its use brought to light a new application for the instrument and solved the problem quickly and accurately. Since the leak detector indicates the presence of helium, a can of this gas under pressure was applied to the head end of a stud under test and the valve opened to put approximately two pounds pressure of helium around the stud. Over the threaded end of the stud on the other side of the cover plate there was placed a suction cup with a rough vacuum in it, and the leak detector was connected to the cup through a valve.

Any helium which was sucked through the gasketed stud hole in the plate was indicated on the output meter of the leak detector. If after 30 seconds no reading was seen on the meter, the valve on the helium can was closed and the can was removed from the stud. At the same time, the operator of the suction cup released the cup from the other side of the plate and the test crew was ready to start the sequence again on the next stud.

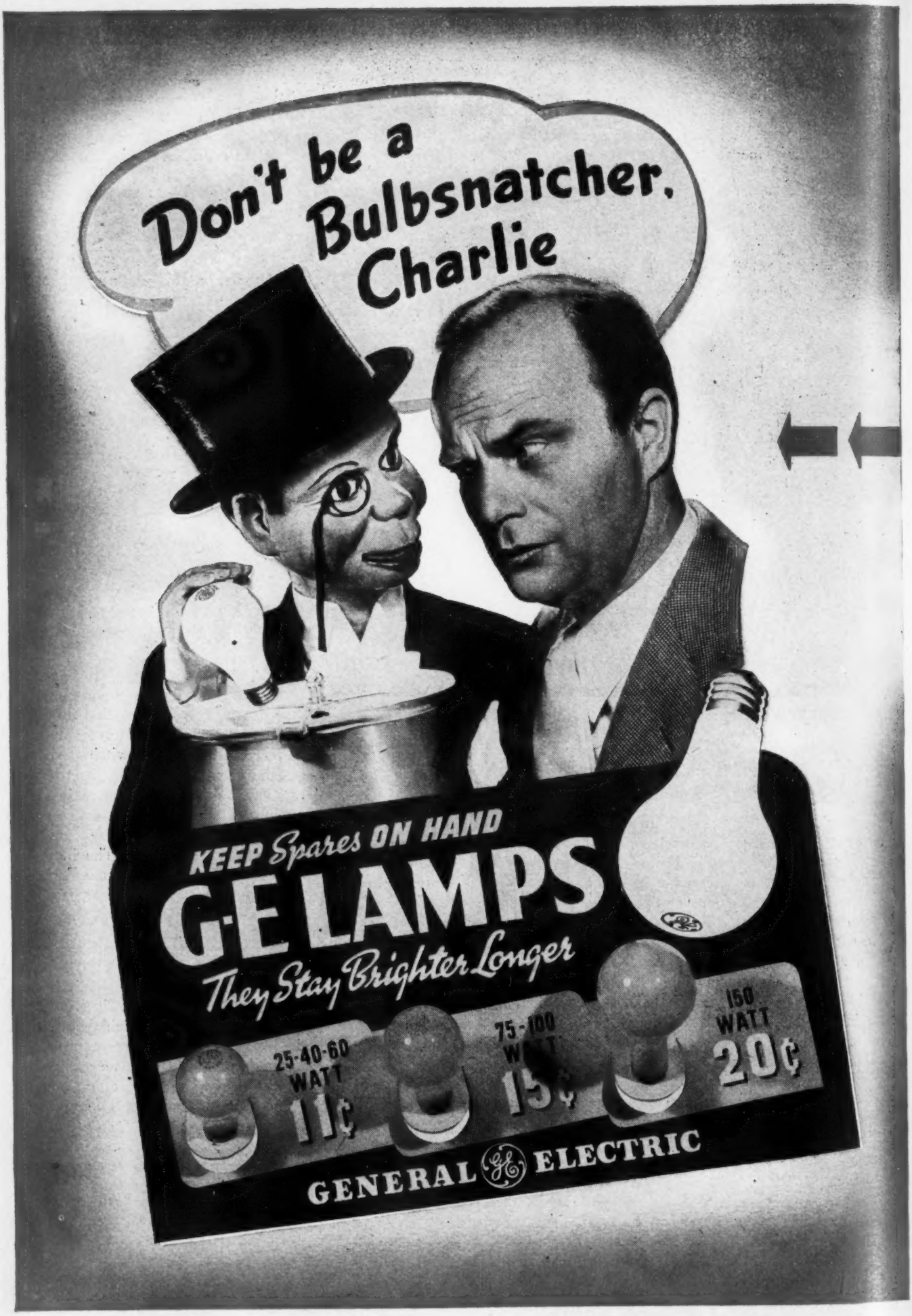
Since the rubber gasket around the edge of the helium can was not absolutely helium tight, an electric fan was trained on the can to disperse any concentration of helium which might have been carried through the air to the leak detector. This was especially useful when the helium can was used on studs near the edges of the cover or near one of the large openings in the cover.

After becoming familiar with the testing procedure, the test crew of three men cut the time of testing a cover plate with the leak detector from three to two days, and by using this method obtained accurate results without the danger of contaminating the oil in the transformer with a soap solution.

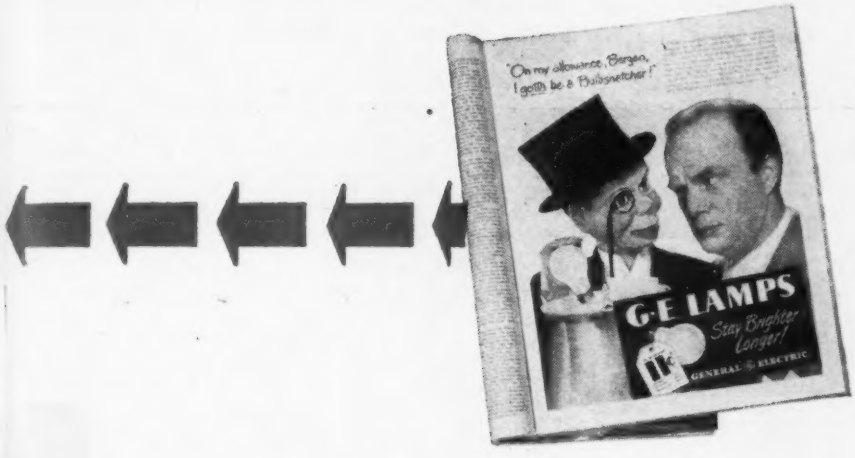
Blueprint Used for Drilling Template

BLUEPRINT Scotch-taped to switchboard panel is used as drilling template

BY MAKING drawings and blue prints to full scale so that they may be used as templates for the installation of switchboard equipment, California Electric Power Co., Riverside, saves time and reduces errors in drilling panels for relays, instruments and other apparatus. The idea came as a suggestion from Earl Maloney, of the company's construction department.


Don't be a Bulbsnatcher, Charlie
KEEP Spares ON HAND
G-E LAMPS
They Stay Brighter Longer
25-40-60 WATT
11¢
75-100 WATT
15¢
150 WATT
20¢
GENERAL ELECTRIC

Watch Charlie McCarthy MOW 'EM DOWN!



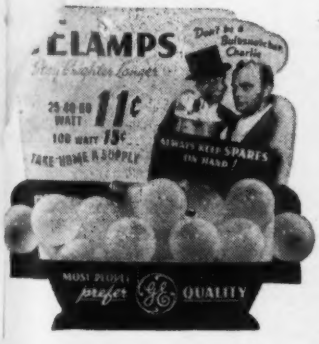
This full-color Bergen-McCarthy bulbsnatching ad appeared in Life, Sept. 16; Collier's, Sept. 14; Saturday Evening Post, Oct. 26. Note how the display ties in!

low this new Bergen-McCarthy display elps to fill empty sockets with G-E Lamps

haps you've never thought of Charlie McCarthy as a er salesman. But that's one of his jobs in General ric's greatest bulbsnatching campaign.

now G-E Lamp dealers all over the country turing this colorful display, with the irrepress- harlie and his famous mouthpiece, Edgar reminding customers to purchase right-size mps to fill those empty sockets. The display *clicks* because it ties in with a powerful campaign of bulbsnatching ads, now appearing in America's favorite magazines.

The ads are full-page, natural color stoppers, presenting some of Hollywood's top comedy talent—Fred Allen, George Burns, Gracie Allen, as well as Bergen & McCarthy—in a mirthful series of bulbsnatching situations. Because it sells G-E Lamps, this campaign builds lighting load for you. Keep an eye out for the Bergen-McCarthy display in your local stores—and watch Charlie *mow 'em down!*



Some dealers are using this gay G-E lamp basket display, featuring "Charlie the Bulbsnatcher". It lets folks know they're headquarters for the lamps that are constantly improved by General Electric Lamp research to *Stay Brighter Longer!*

Conductor Constants Afford Exact Voltage Drop Calculations

N. H. ERLANDSON, Distribution Design Engineer, and
W. R. BUCHANAN, Electrical Engineer, Carolina Power & Light Co., Raleigh, N. C.

Constants of complex quantities used in determining percent voltage drop are listed for various kinds and sizes of conductors, two spacings and three lagging power factors. These constants or volts-drop-per-ampere data may be used where complex quantities are desirable.

TABLE gives the volts drop per mile per ampere which are calculated from

$$(R + jX)(\cos\theta - j\sin\theta)$$

with the voltage to neutral as a reference. Since the tabulated values are based on amperes, the constants are suitable for any of the voltages included in the two values of spacings given.

Example for Use of Table

Problem:

Determine percent voltage drop for an 800-kva. load and the following conditions—80 percent power factor, 3 miles from power source, No. 2 copper conductors, receiver voltage 11,950, and 5-ft. conductor spacing.

Solution:

$$I = \frac{800}{11.950 \times 1.732} = 38.65 \text{ amp.}$$

Volts drop per mile, 5-ft. spacing, No. 2 copper, 80 percent power factor, from table

$$= 1.17 + j0.11$$

Volts drop due to load of 38.65 amp. and a distance of 3 miles

$$= 3 \times 38.65\,(1.17 + j0.11)$$
$$= 135.66 + j12.75$$

Voltage at sending end (to neutral)

$$E_{sn} = \left(\frac{11950}{1.732} + j0\right) + (135.66 + j12.75)$$

$$E_{sn} = 6900 + j0 + 135.66 + j12.75$$
$$= 7035.66 + j12.75$$
$$= 7035.67$$

Percent voltage drop

$$= \frac{7035.67 - 6900}{6900} \times 100 = 1.97$$

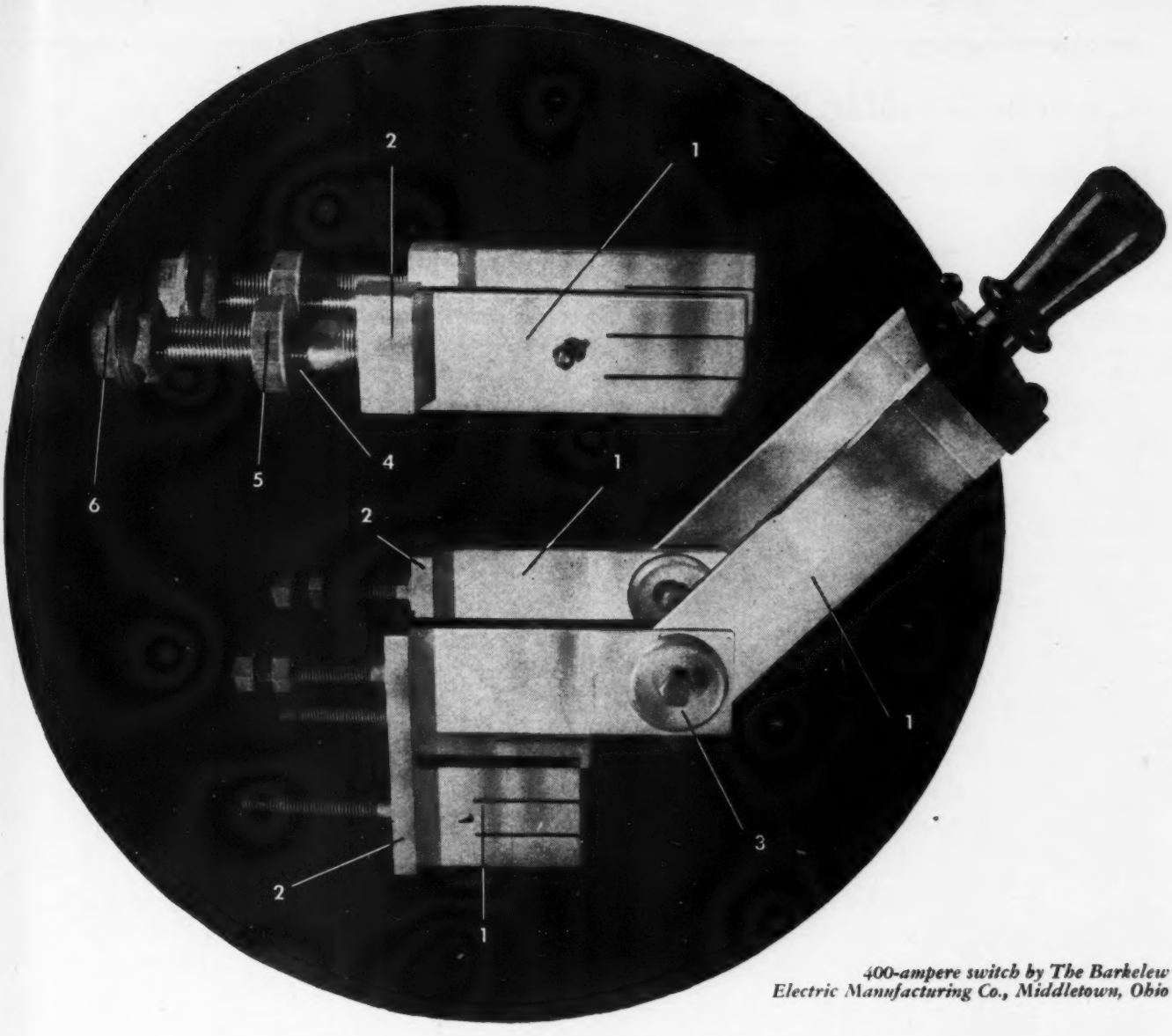
Conductor Constants for Various Power Factors and Spacing

3-FT. SPACING

Conductor size and type	Power Factor 95%	80%	40%
8 Cu solid	3.55 − *j*0.32	3.26 − *j*1.44	2.12 − *j*2.88
6 Cu solid	2.32 + *j*0.05	2.21 − *j*0.70	1.58 − *j*1.70
4 Cu solid	1.54 + *j*0.27	1.54 − *j*0.23	1.23 − *j*0.96
2 Cu solid	1.05 + *j*0.41	1.13 + *j*0.06	1.00 − *j*0.51
1 Cu strand	0.88 + *j*0.44	0.98 + *j*0.13	0.92 − *j*0.36
1/0 Cu strand	0.74 + *j*0.48	0.85 + *j*0.21	0.84 − *j*0.24
2/0 Cu strand	0.63 + *j*0.49	0.75 + *j*0.27	0.79 − *j*0.14
3/0 Cu strand	0.53 + *j*0.51	0.67 + *j*0.31	0.74 − *j*0.06
4/0 Cu strand	0.46 + *j*0.52	0.60 + *j*0.34	0.70 + *j*0.00
6 HTC80–5A	11.39 + *j*0.16	10.84 − *j*3.53	7.71 − *j*8.46
6 HTC80–10A	13.45 + *j*1.04	13.08 − *j*3.34	9.75 − *j*9.40
6 HTC80–15A	16.97 + *j*1.74	16.64 − *j*4.09	12.62 − *j*11.58
6 HTC80–20A	19.64 + *j*1.94	19.22 − *j*4.50	14.53 − *j*13.45
6 HTC80–25A	20.97 + *j*2.01	20.51 − *j*4.86	15.56 − *j*14.61
4 HTC80–5A	8.58 + *j*0.80	8.39 − *j*2.01	6.32 − *j*5.92
4 HTC80–10A	10.19 + *j*1.51	10.14 − *j*1.86	7.72 − *j*6.65
4 HTC80–15A	13.09 + *j*2.11	13.08 − *j*2.22	10.30 − *j*8.43
4 HTC80–20A	15.30 + *j*2.36	15.25 − *j*2.70	11.96 − *j*9.91
4 HTC80–25A	16.63 + *j*2.38	16.51 − *j*3.11	12.96 − *j*10.90
8 C.W.–30%	10.99 − *j*2.63	9.57 − *j*6.03	5.36 − *j*10.01
8 C.W.–40%	9.32 − *j*1.75	7.32 − *j*4.34	4.23 − *j*7.41
6 C.W.–30%	7.02 − *j*1.35	6.21 − *j*3.54	3.66 − *j*6.16
6 C.W.–40%	5.34 − *j*0.80	4.80 − *j*2.48	2.95 − *j*4.54

5-FT. SPACING

Conductor size and type	Power Factor 95%	80%	40%
8 Cu solid	3.57 − *j*0.26	3.30 − *j*1.39	2.18 − *j*2.86
6 Cu solid	2.34 + *j*0.12	2.25 − *j*0.65	1.63 − *j*1.68
4 Cu solid	1.56 + *j*0.33	1.58 − *j*0.18	1.29 − *j*0.94
2 Cu solid	1.08 + *j*0.47	1.17 + *j*0.11	1.06 − *j*0.48
1 Cu strand	0.90 + *j*0.50	1.01 + *j*0.18	0.97 − *j*0.34
1/0 Cu strand	0.76 + *j*0.53	0.88 + *j*0.26	0.90 − *j*0.21
2/0 Cu strand	0.65 + *j*0.55	0.79 + *j*0.32	0.85 − *j*0.12
3/0 Cu strand	0.55 + *j*0.57	0.71 + *j*0.36	0.80 − *j*0.04
4/0 Cu strand	0.48 + *j*0.58	0.64 + *j*0.39	0.77 + *j*0.03
6 HTC80–5A	11.41 + *j*0.21	10.87 − *j*3.48	7.76 − *j*8.43
6 HTC80–10A	13.47 + *j*1.11	13.12 − *j*3.29	9.81 − *j*10.37
6 HTC80–15A	16.99 + *j*1.80	16.67 − *j*3.77	12.67 − *j*11.55
6 HTC80–20A	19.66 + *j*2.00	19.26 − *j*4.45	14.59 − *j*13.43
6 HTC80–25A	20.99 + *j*2.07	20.55 − *j*4.82	15.62 − *j*14.59
4 HTC80–5A	8.60 + *j*0.85	8.43 − *j*1.97	6.37 − *j*5.90
4 HTC80–10A	10.21 + *j*1.57	10.18 − *j*1.81	7.98 − *j*6.63
4 HTC80–15A	13.11 + *j*2.16	13.12 − *j*2.18	10.36 − *j*8.41
4 HTC80–20A	15.32 + *j*2.42	15.29 − *j*2.65	12.02 − *j*9.89
4 HTC80–25A	16.65 + *j*2.45	16.55 − *j*3.06	12.92 − *j*10.87
8 C.W.–30%	11.01 − *j*2.57	9.61 − *j*5.98	5.41 − *j*9.99
8 C.W.–40%	8.34 − *j*2.00	7.38 − *j*4.27	4.28 − *j*7.39
6 C.W.–30%	7.04 − *j*1.29	6.24 − *j*3.49	3.72 − *j*6.14
6 C.W.–40%	5.26 − *j*0.74	4.83 − *j*2.43	3.01 − *j*4.52



400-ampere switch by The Barkelew Electric Manufacturing Co., Middletown, Ohio

WIDE VARIETY OF REVERE METALS PERMITS EXACT SPECIFICATION TO MEET CONDITIONS OF USE

Note the number of different Revere Metals used by Barkelew in this switch, in order to assure low losses, reliability, accuracy, long life and economical manufacture.

1. *Electrolytic Copper.* For full conductivity.
2. *Free-Cutting Copper.* For quick, economical, trouble-free machining; in this case, producing sharp, clean, accurate slots and tapped holes in the copper base blocks. Free-cutting copper is rated in excess of 70% machinability of free-cutting brass, depending on type of operation.
3. *Herculoy.* Has the strength of mild steel, the corrosion-resistance of copper. The Herculoy washers in this switch assure permanence of pressure.
4. *Brass.* Washers, stamped out of sheet.
5. *Free-Cutting Brass.* Nuts, machined from free-cutting rod.
6. *Cast Electrolytic Copper.* For nuts not presenting machining problems.

Materials were very carefully chosen in designing this switch. For example, the hinge block for the high clip must have two slots milled in it to receive the clip leaves; Revere Free-Cutting Copper was selected for its superior machining characteristics. Slots in the lower hinge blocks are sawed all the way through, and here Revere Hard Drawn Electrolytic Copper is suitable.

Revere will gladly cooperate with you in working out the most advantageous application of metals to your products. Revere Metals are: Copper and Copper Alloys, Aluminum and Magnesium Alloys, Electric Welded Steel Tube.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.

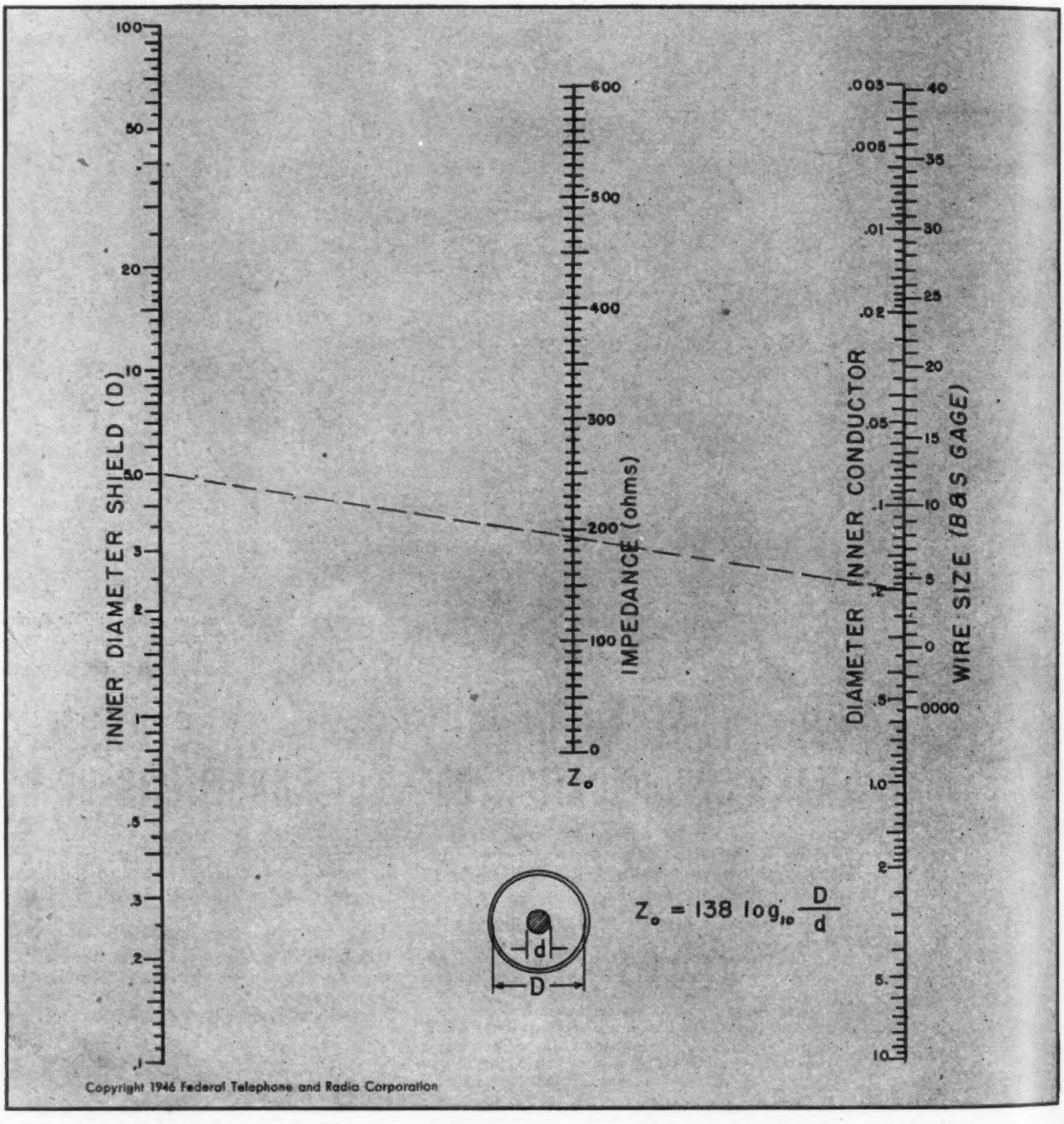
• • •

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p. m., EST.

Characteristic Impedance of Lines*

I—Concentric Line, Air Spaced, for Wire

KARL ZIMMERMANN, *Engineer, Intelin Division, Federal Telephone Radio Corp., New York, N. Y.*



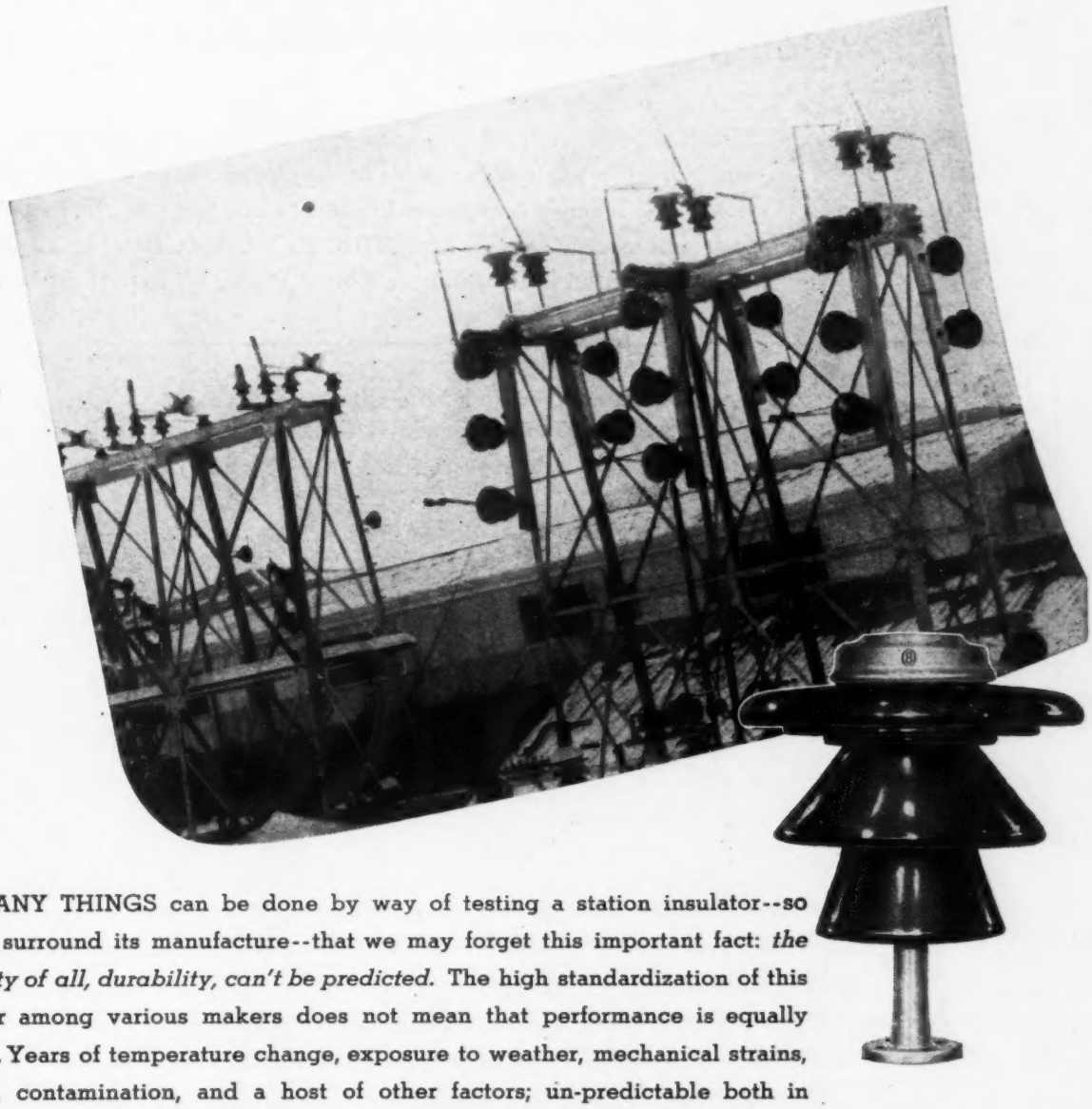
THE CHARACTERISTIC IMPEDANCE of a uniform line is the ratio of an applied potential difference to the resultant current at the point where the potential difference is applied, when the line is of infinite length. (A.I.E.E. definition)

This chart gives theoretically exact values of impedance for any ratio of diameters, assuming perfect conductors and a lossless dielectric (vacuum, air or gas). The maximum impedance obtainable on this chart is 600 ohms. A line connecting D to d will cross the Z_o scale at the surge impedance.

* Beginning a series of five articles on this subject.

AFTER 30 YEARS---

THESE O-B STATION INSULATORS HOLD NO SECRETS



SO MANY THINGS can be done by way of testing a station insulator--so many standards surround its manufacture--that we may forget this important fact: *the most vital quality of all, durability, can't be predicted.* The high standardization of this type of insulator among various makers does not mean that performance is equally standardized!...Years of temperature change, exposure to weather, mechanical strains, electrical stress, contamination, and a host of other factors; un-predictable both in combination and intensity, leaves the problem of ultimate life a wide-open question, except for answers derived from years of field experience... After 30 years, an insulator holds no secrets. It has answered the question, "How long will it last?", if not fully, at least to a satisfying extent. Its past has already justified its selection and its future becomes an added dividend paid on good judgment. On the basis of service records that leave no room for argument, your soundest choice of station insulators is O-B.

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD.,
NIAGARA FALLS, ONT.

HEADQUARTERS FOR PORCELAIN INSULATION

2660-H

Pole Replacement Tables Yield Minimum Ground Line Circumference—II

E. S. JACKSON, *Electric Distribution Department, Consumers Power Co., Jackson, Mich.*

SUMMATION TABLES give ground line circumference of Western red cedar and Northern white cedar poles at replacement for Grade C (or B) construction. Pole loading is expressed in terms of "wire equivalents" derived from instructions and data in ELECTRICAL WORLD, October 12, 1946, page 110. Tables are used by Consumers Power Co. to guide pole replacement program

Minimum Ground Line Circumferences At Replacement Grade C Construction

(For Grade B Multiply Circumferences by 1.26)

Table II—Western Red Cedar

Wire Equiv.	Average Span Length in Feet															
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
1	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
2	15	15	15	15	15	15	15	15	15	15	15	15½	16	16	16½	16½
3	15	15	15	15	15	15	15½	16	16½	16½	17	17½	17½	18	18½	18½
4	15	15	15	15½	16	16½	17	17½	18	18	18½	19	19	19½	20	20
5	15	15	16	16½	17	17½	18	18½	19	19½	20	20	20½	21	21½	21½
6	15	16	16½	17½	18	18½	19	19½	20	20½	21	21½	22	22	22½	23
7	16	16½	17½	18	19	19½	20	20½	21	21½	22	22½	23	23½	23½	24
8	16½	17½	18	19	19½	20	21	21½	22	22½	23	23½	24	24½	24½	25
9	17	18	19	19½	20	21	21½	22	22½	23½	24	24½	25	25	25½	26
10	17½	18½	19½	20	21	21½	22	23	23½	24	24½	25	25½	26	26½	27
11	18	19	20	21	21½	22	23	23½	24½	25	25½	26	26½	27	27½	28
12	18½	19½	20½	21½	22	23	23½	24½	25	25½	26	26½	27	28	28½	29
13	19	20	21	22	22½	23½	24½	25	25½	26	26½	27½	28	28½	29	30
14	19½	20½	21½	22½	23½	24	25	25½	26	27	27½	28	28½	29½	30	30½
15	20	21	22	23	24	24½	25½	26	26½	27½	28	29	29½	30	30½	31
16	20	21½	22½	23½	24½	25	26	26½	27½	28	29	29½	30	30½	31	31½
17	20½	21½	23	24	25	25½	26½	27	28	28½	29½	30	30½	31	32	32½
18	21	22	23½	24½	25	26	27	28	28½	29½	30	30½	31	32	32½	33
19	21½	22½	23½	24½	25½	26½	27½	28½	29	30	30½	31	32	32½	33	33½
20	21½	23	24	25	26	27	28	29	29½	30½	31	31½	32½	33	33½	34
21	22	23½	24½	25½	26½	27½	28½	29½	30	31	31½	32	33	33½	34	35
22	22	23½	25	26	27	28	29	29½	30½	31½	32	32½	33½	34	34½	35½
23	22½	24	25	26	27½	28½	29½	30	31	31½	32½	33	34	34½	35	36
24	23	24½	25½	26½	28	29	29½	30½	31½	32	33	33½	34½	35	35½	36½
25	23½	24½	26	27	28	29	30	31	32	32½	33½	34	35	35½	36½	37
26	23½	25	26	27½	28½	29½	30½	31½	32	33	34	34½	35½	36	37	37½
27	24	25	26½	28	29	30	31	32	32½	33½	34½	35	36	36½	37½	38
28	24	25½	27	28	29½	30½	31½	32	33	34	35	35½	36½	37	38	38½
29	24½	26	27	28½	29½	30½	31½	32½	33½	34½	35	36	37	37½	38½	39
30	24½	26	27½	29	30	31	32	33	34	35	35½	36½	37½	38	38½	39½
32	25	26½	28	29½	30½	31½	32½	33½	34½	35½	37	37½	38	39	39½	40½
34	25½	27	28½	30	31	32½	33½	34½	35½	36½	37½	38	39	39½	40½	41
36	26	28	29	30½	32	33	34	35½	36	37	38	39	39½	40½	41	42
38	26½	28½	30	31	32½	33½	34½	36	37	38	38½	39½	40½	41	42	42½
40	27	29	30½	31½	33	34	35½	37	37½	38½	39½	40½	41	42	42½	
42	27½	29	30½	32	33½	35	36	37	38	39	40	41	42	42½	43½	44
44	28	29½	31	32½	34	35½	37	37½	39	40	40½	41½	42½	43½	44	44½
46	28½	30	31½	33	34½	36	37	38½	39½	40½	41½	42	43	44	44½	45½
48	28½	30½	32	33½	35	36½	37½	39	40	41	42	43	43½	44½	45½	46
50	29	31	32½	34	35½	37	38½	39½	40½	41½	42½	43½	44	45	46	46½

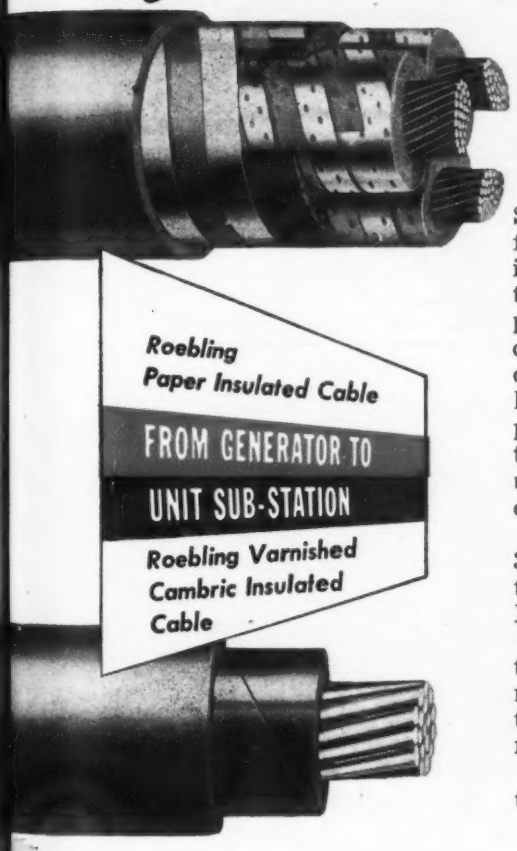
Table III—Northern White Cedar

Wire Equiv.	Average Span Length in Feet															
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
1	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
2	18	18	18	18	18	18	18	18	18	18	18	18	18½	18½	19	19
3	18	18	18	18	18	18	18	18½	19	19½	19½	20	20½	21	21½	21½
4	18	18	18	18	18½	19	19½	20	20½	21	21½	22	22½	23	23½	23½
5	18	18	18½	19	19½	20½	21	21½	22	22½	23	23½	24	24½	25	25½
6	18	18½	19½	20	21	21½	22	23	23½	24	24½	25	25½	26	26½	27
7	18½	19½	20	21	21½	22½	23½	24	24½	25	25½	26½	27	27½	28	28½
8	19	20	21	22	23	23½	24½	25	25½	26½	27	27½	28	28½	29	29½
9	19½	21	21½	23	24	24½	25½	26	26½	27½	28	28½	29	29½	30	30½
10	20½	21½	22½	23½	24½	25½	26	27	27½	28½	29	29½	30	30½	31½	32
11	21	22	23½	24½	25½	26	27	27½	28½	29	30	30½	31	31½	32½	33
12	21½	23	24	25	26	27	27½	29	29½	30	30½	31½	32	32½	33½	34
13	22	23½	24½	25½	26½	27½	28½	29½	30	31	31½	32	33	33½	34	35
14	22½	24	25	26½	27½	28½	29	30	31	31½	32½	33	34	34½	35	36
15	23	24½	25½	27	28	29	30	30½	31½	32½	33	34	34½	35½	36	37
16	23½	25	26½	27½	28½	29½	30½	31½	32	33	34	34½	35½	36	37	38
17	24	25½	27	28	29	30	21	32	33	34	34½	35½	36	37	38	38½
18	24½	26	27½	28½	29½	30½	31½	32½	33½	34½	35½	36	37	38	38½	39½
19	25	26½	28	29	30	31½	32½	33½	34	35	36	37	38	38½	39½	40
20	25½	27	28½	29½	30½	32	33	34	35	36	37	38	38½	39½	40	40½
21	25½	27½	29	30	31	32½	33½	34½	35½	36½	37½	38½	39	40	40½	41½
22	26	27½	29	30½	31½	33	34	35	36	37½	38	39	40	40½	41	42
23	26½	28	29½	31	32	33½	34½	35½	37	38	38½	39½	40½	41	42	42½
24	27	28½	30	31½	32½	34	35	36½	37½	38½	39½	40	41	42	42½	43½
25	27	29	30½	32	33	34½	35½	37	38	39	40	41	41½	42½	43	44
26	27½	29½	31	32	33½	35	36	37½	38½	39½	40½	41½	42	43	43½	44½
27	28	29½	31	32½	34	35½	36½	38	39	40	41	42	42½	43½	44½	45
28	28½	30	31½	33	34½	36	37	38½	39½	40½	41½	42½	43	44	45	45½
29	29	30½	32	33½	35	36½	37½	39	40	41	42	43	43½	44½	45½	46
30	29	30½	32½	34	35½	37	38	39½	40½	41½	42½	43½	44	45	46	46½
32	29½	31	33	34½	36½	37½	39	40	41½	42½	43½	44	45	46	46½	47
34	30	32	33½	35½	37	38½	40	41	42	43	44	45	46	46½	47½	48
36	30½	32½	34½	36	38	39½	40½	42	43	44	45	46	46½	47½	48	49
38	31	33	35	37	38½	40	41½	42½	43½	45	45½	46½	47½	48	49	49½
40	32	34	35½	37½	39½	40½	42	43½	44½	45½	46½	47	48	49	49½	50½
42	32½	34½	36½	38½	40	41½	43	44	45	46	47	48	49	49½	50½	51
44	33	35	37	39	40½	42	43½	45	45½	46½	47½	48½	49½	50	51	52
46	33½	35½	38	39½	41	42½	44	45½	46½	47½	48½	49	50	51	51½	52½
48	34	36	38½	40	42	43½	44½	46	47	48	49	50	50½	51½	52½	53
50	34½	37	39	40½	42½	44	45	46½	47½	48½	49½	50½	51½	52	53	54

VOLTAGE ALL THE WAY

for lower losses... higher capacity

WITH ROEBLING POWER CABLES



STEADILY INCREASING LOADS are focussing new interest in bringing high voltage power all the way to unit sub-stations. Lowered power losses and greater current carrying capacity are among the opportunities opened up. And in handling loads like these, Roebling power cables have earned a reputation for performance among utility engineers and electrical contractors alike.

At voltages from 13,000 to 33,000 for 3-phase grounded neutral circuits, for example, consider Roebling Paper Insulated Cable (Shielded Type H). It provides the simplicity of installation and maintenance that only a "solid" type cable can give, plus high current carrying efficiency.

For voltages up to 17,000 between phases . . . and up to 26,000 for single conductor grounded neutral (for power, heat or lighting circuits) the choice is Roebling Varnished Cambric Insulated Cable. In sub-stations, mines, industrial plants—wherever operating temperatures are high — it's preferred for transformer and oil switch leads, as well as generator and motor leads.

Both types meet the fundamental considerations of *safety, adequacy* for the required service, and unquestioned *reliability* . . . as do *all* Roebling electrical cables. It's a combination of research and engineering, materials and methods that assures this result.

Call in a Roebling engineer. He can show you more than one way of solving high-voltage cable problems to your advantage.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

BLING

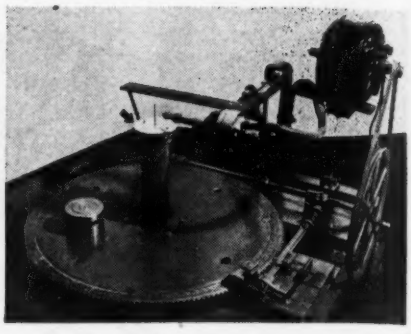
JR ROEBLING

WIRES AND CABLES

Old Style Meter Discs Are Notched for Strobo Testing

R. J. McKNIGHT
Central Arizona Light & Power Co.
Phoenix

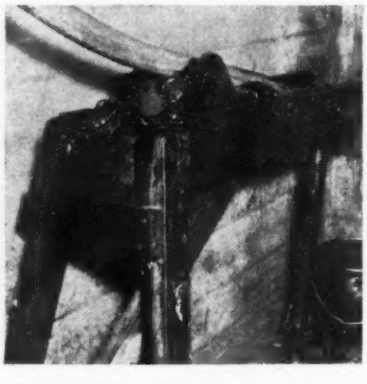
AFTER strobo testing equipment was installed by the Central Arizona Light & Power Co., it was decided to test all of the older meters on the system by the same method as they came through the shop. To do this necessitated notching of the old discs and there arose the problem of how to do the notching. The machine illustrated proved the solution. It consists of the large-toothed steel wheel shown to turn the meter disc in the mandrel the necessary increment while the cutting saw automatically saws the teeth. Two of the large toothed wheels are provided, one with 180 teeth for G.E. I-14 and I-16 meters and the other with 200 teeth for Westinghouse meters. With the 180-tooth wheel two saws are used to cut 360 notches for I-14 meters and four saws to cut 720 notches for I-16's. With the 200-tooth wheel two saws cut 400 notches for Westinghouse meters having a basic constant of 1/3. A bank of mica undercutting saws on the shaft of a pneumatic motor is used to cut the notches. One of the discs of a polyphase meter may likewise be notched so that old three-phase meters may also be strobo tested.



METER DISC notching device for old style meters makes possible strobo testing. Steel weight seen on large wheel is placed on disc when machine is in operation

This equipment, made by the company's machinist, permits a uniform test method for all meters and makes possible taking advantage of the speed and accuracy of strobo testing for old as well as new meters.

• • •



VIEW of home-made trough for lubricating cable en route to duct

Lead-In Trough Speeds Cable Work

A CONVENIENT TROUGH for lubricating and guiding 110-kv. oil-filled cable into duct line was employed by the Boston Edison Co. in the construction of the new Mystic-Woburn connection. The trough was of oak to prevent trouble from splintering and give smoothness of surface in feeding the cable through. It was 6 in. wide inside, with walls 3 in. high and an over-all length of 3 ft. This gave ample space for holding cable grease, through which the sheath was passed on the way to the duct entrance. The front leg of the trough-supporting structure was built of 2½-in. pipe, inside which a 2-in. pipe slides up and down, with holes and pin for holding the two together at any desired height in order to maintain the correct line-up for duct entrances, and to prevent abrasion of the cable sheath.

• • •

Seal Cellulose Acetate with High Frequency

E. K. CLIVER

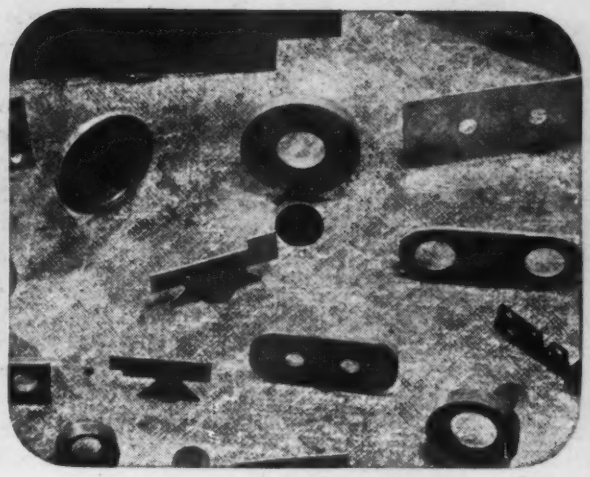
Product Application Dept., Celanese Plastics Corp., New York, N. Y.

THE THERMOPLASTIC cellulose acetate in thicknesses of 0.030 in. and up can be heated and sealed readily in a high-frequency electrostatic field. For thin films, however, the relatively low dielectric loss and high softening point (over 140 deg. C.) bring the heat input closer to the heat loss by conduction and radiation, at the lower frequencies used for bonding plywood and heating preforms. Thin materials necessitate lower voltage and thus limit voltage as a means for getting heat into the film, so other means must be found.

Some of the standard formulas giving the heat and power required to soften plastic materials in bulk consider such properties as volume, specific heat, dielectric constant and power factor but the thickness as such is not considered. For example:

$$P = 1.41 \times f \times E^2 \times e, \text{ (watts/cu. in.)}$$

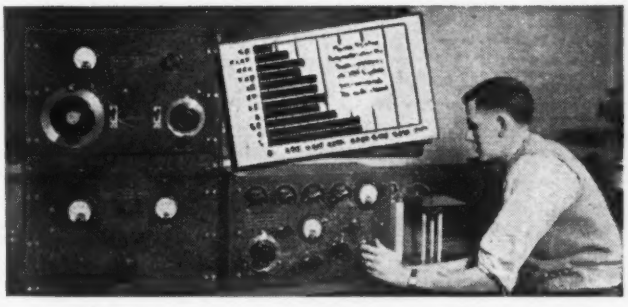
where P = power density, f = frequency (Mc/sec.), E = voltage gradient in dielectric (kv./in.) and e = loss factor, considers only the volume, so that for constant volume and voltage gradient the power input



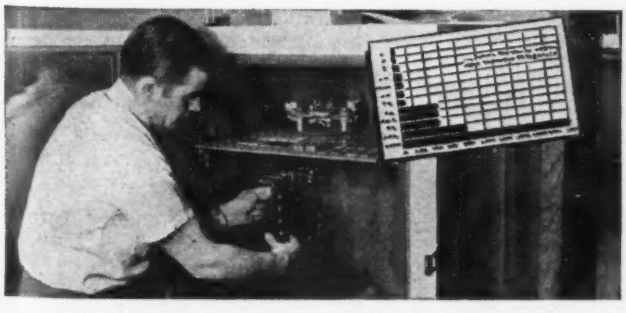
Micabond, **all desirable characteristics of Mica in its most usable form.**

Celoron, **similar to Dilecto but molded into desired shapes.**

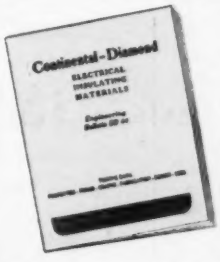
EFFECTIVE YARDSTICKS by which you can predetermine the performance of C-D insulating materials



Power Factor Test on Standard Dilecto Grades—The standard test method is called the Resonant Circuit Resistance Variation Method. Measurements are at 10^6 cycles per second. Equipment for this test consists of a stable high frequency generator, a vacuum tube voltmeter, decade resistors, and a Standard Precision Type Variable Air Condenser.



Insulation Resistance Test on Various Grades of Dilecto—This is one of several test procedures necessary to evaluate an insulating material, and for classifying various types and grades of such material. The test serves also to establish the relative uniformity of the material.



Nine tests similar to and including those above are fully reported in detail in our Bulletin ED44. You will also find valuable engineering, specification and design data as well as useful information on fabricating C-D laminated plastics, fibre and mica products. Send for this 32 page book without delay.

C-D PRODUCTS

THE PLASTICS

DILECTO—Thermosetting Laminates.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

THE NON-METALLICS

DIAMOND Vulcanized FIBRE.
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

STANDARD and SPECIAL FORMS

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

DESCRIPTIVE LITERATURE

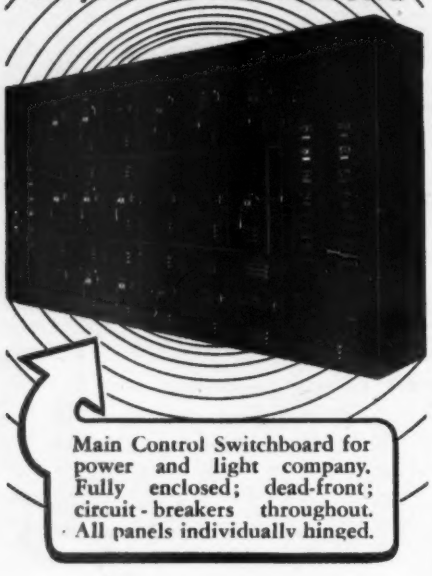
Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

Continental-Diamond
C-D
Engineered Molded Plastics

Why it will pay you to try

Pelham

for your next Switchboard



Main Control Switchboard for power and light company. Fully enclosed; dead-front; circuit-breakers throughout. All panels individually hinged.

1. Exceptional Engineering Service. The wide experience of our Engineering Department has included the most difficult problems of switchboard design. We can send an engineer to combine our experience with yours in planning a job.

2. Highest Standards. The wide preference for Pelham Switchboards is largely due to the knowledge of electrical engineers that "Pelham" on a board definitely guarantees the best of materials and workmanship.

3. Unusual Cooperation. We take full responsibility for meeting all specifications of architects and engineers, as well as municipal, state, or federal requirements. Our deliveries are made when promised.

PELHAM ELECTRIC MFG. CORP.
Erie, Pa.

SPECIALIZED DESIGN
Pelham
UNEXCELLED QUALITY
SWITCHBOARDS • PANEL BOARDS
SWITCH GEAR AND ACCESSORIES

appears to be constant regardless of the thickness. And in the formula:

$$T = \frac{W(H)\Delta t}{56.9\ (KW)}$$

where T = time in minutes to raise temperature of material to be heated Δt, W = weight of material to be heated in pounds, H = specific heat of material, Δt = rise in temperature in degrees F., and 56.9 = 3,413 Btu./60 min., only the total weight is considered. For thin films T will generally be considerably longer than this equation indicates as heat loss due to conduction is not accounted for, nor is the effect of frequency. Other factors affecting T for thin films are voltage, pressure and electrode temperature.

Some investigators have looked into the effect of the thickness factor and some formulas taking this into account can be found in booklets published by R.C.A. Laboratories, written by George H. Brown** and Cyril N. Hoyler***. Nevertheless, after the basic principles are understood, cut and try will probably bear quicker results using a machine adapted to the work at hand. This is important also because unless the generator is adapted to the work even a 10-kw. generator may not be able to make a seal requiring only a few watts.

Another item of importance is electrode design. The best approach to the sealing of thin cellulose acetate films (3 to 10 mils) appears to be: (1) Select the highest frequency available (at least 27 Mc., preferably 200 Mc.); (2) keep the mass of metal in the electrodes as low as practicable; (3) insulate the electrodes from the film in order to hold heat in the film; (4) keep the air surrounding the electrodes as warm as possible by the application of warm air or by enclosing the electrodes; (5) apply some pressure (50 to 500 psi.) The amount of pressure will depend on the thickness of the acetate and other factors such as frequency, electrode temperature and voltage gradient. Indications are that a desirable electrode can be made by plating a conducting surface on a low loss electricity and heat insulator and coating the conducting surface with a low loss resin. The problem of insulating the "hot" electrode from the press frame is simplified and heat loss to the electrodes from the film to be sealed is greatly reduced.

Commercial dielectric sewing machines should be able to seal acetate in thicknesses of a few mils if the properties of cellulose acetate are kept in mind when the machine and electrodes are designed. Problems in sealing cellulose acetate should be discussed with the manufacturers of sealing equipment.

* Formulas for High-Frequency Heating; compiled by Westinghouse Electric Corp., Baltimore, Md., ELECTRICAL WORLD, November 24, 1945, page 110.

** BROWN, GEORGE M. Heat-Conduction Problems in Presses Used for Gluing of Wood. Reprinted from *Proceedings* of the Institute of Radio Engineers, October 1943.

*** Hoyler, Cyril N. An Electronic "Sewing Machine," Reprinted by permission from *Electronics*, August 1943.

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Grand Coulee Drops 410 Mw. But Northwest Pool Holds Together

SOME MONTHS AGO a complete shutdown of the Grand Coulee power plant precipitated a major disturbance on the Bonneville Power Administration grid. Some time has elapsed in securing the following official statement but, although the incident has lost news value, the chronology of events and the lessons learned are still of interest to operators. The immediate cause of the outage was loss of excitation to the main generators. Within a few seconds the machines went out of step with the remainder of the system and were disconnected manually. The outage continued for 12 min., but action by the dispatchers averted any serious consequences.

Loss of the Grand Coulee output, 410 megawatts, was felt throughout the Northwest Power Pool embracing all major systems in a five-state area. As the frequency of the system coasted downward, the Administration's dispatchers ordered curtailment of aluminum reduction loads. Hydro generators at the Bonneville plant and on the Seattle, Tacoma, and Utah systems were immediately pushed to full output. Steam reserves in the Portland, Puget Sound, and Salt Lake City areas likewise were pushed as far as the limitations of available steam and tie capacity would permit. The added generation checked the downward drift, but was insufficient.

ANSFORMERS

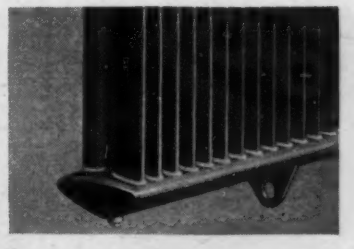
50 YEARS OF LEADERSHIP

Based on constant research directed solely to the manufacture of transformers . . . on an organization of highly trained specialists in both the engineering and construction of transformers . . . from small distribution types to large high voltage power units. Both these factors have enabled Moloney to pioneer in the development of many modern features in transformer design.

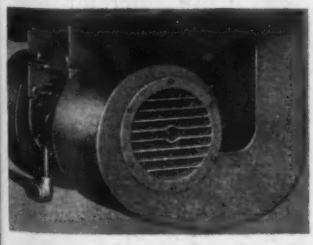
Check these features ✓✓

gineering Reseach, the vital factor in improvement of design, processing and fabrication, has earned for Moloney the title of Pioneer in the Transformer field. It is the reason industry looks to Moloney for new developments in design and efficiency.

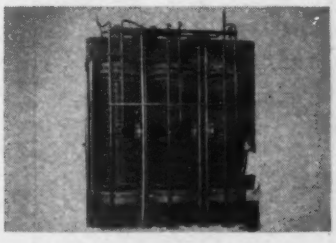
Tanks are made of high grade steel, electrically welded, with rugged Z-bars or sturdy, welded, box type reinforcement. Bases are of heavy channel iron construction preventing distortion of base or tank when handling transformers. Careful pressure testing assures leakproof construction.



Radiators are of all-welded construction. Tubes are spaced in a double row for easy cleaning and painting. There is no "hard-to-get-at" center row! All welds are external. Headers are designed so that water cannot collect and cause rust.

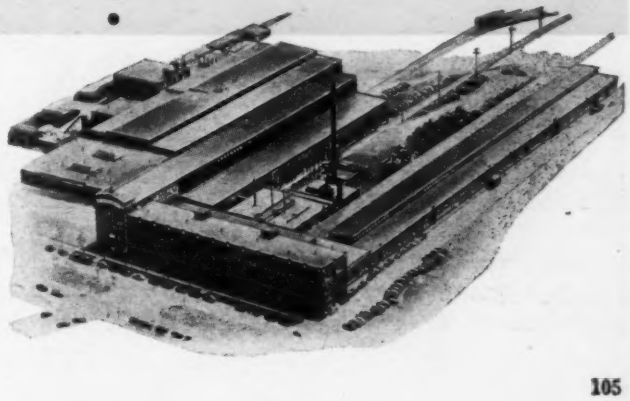


here forced air cooling equipment is required on large power transformers, blowers are the centrifugal type. Automatically controlled by oil or hot spot temperature. Driven by weatherproofed motors with self-lubricating ball bearings which require no attention.



Core type construction is standard on all Moloney Power Transformers, thus maximum amount of winding surface is exposed to oil. Circular windings provide greatest possible protection against distortion under the most severe operating conditions.

Preparing to test a power transformer. Besides numerous test boards for standard transformer tests, the Moloney 2,500,000 volt surge generator, with its recording cathode ray oscillograph, is available for impulse testing.



ENGINEERING • RESEARCH

TRANSFORMERS EXCLUSIVELY SINCE 1896

☆ **SAINT LOUIS 20, MO.**

BRONZE BOLTS
STAND THE STRAIN
Suspend 3 Miles of Drill Pipe

In modern oil wells the draw works are often required to lower and hoist more than 15,000 feet of drill pipe. Think of it! 3 miles of pipe weighing 30 pounds per foot!

Brakes on the draw works are constantly in use sustaining the entire load. For this rugged service Raybestos-Manhattan, Inc., have perfected a brake block and fastening device which depends upon Harper Bronze Bolts to withstand the shearing force of this tremendous weight.

Harper Everlasting fastenings made from high strength nonferrous and stainless steel alloys are consistently specified by engineers to fight damp, rust-producing atmospheres and corrosive chemicals that would soon weaken common steel.

When you have a fastening problem in your industry, Harper engineers can help you.

THE H. M. HARPER COMPANY
2611 Fletcher Street, Chicago 18, Illinois

Branch Offices: New York City, Philadelphia, Los Angeles, Milwaukee, Cincinnati, Dallas
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Draw Works on a modern oil well.

Bronze bolts hold Raybestos-Manhattan blocks securely. May be loosened easily for installation of new blocks.

MORE THAN 4850 TYPES OF EVERLASTING
FASTENINGS IN BRASS, NAVAL BRONZE, SILICON BRONZE, MONEL, STAINLESS

without Grand Coulee, to restore normal frequency on the grid.

As steps were being taken to curtail the aluminum loads, other contingencies arose. Overloaded ties between Spokane and the Montana system opened, thereby cutting off support from that utility and the Salt Lake area. The Shuffleton steam plant in the Puget Sound area was forced to reduce generation temporarily because of low steam pressure. Again the system frequency sagged downward. As rapidly as possible, more aluminum potlines were dropped; two paper mills in the Portland area were curtailed; and the downward trend of system frequency was finally reversed.

Prompt Action

While these fast-moving events were taking place, Grand Coulee had likewise been busy. Excitation was restored to the main generators, and manual adjustments were made to permit resynchronizing with the remainder of the system at reduced frequency. Even as the above loads were being dropped, the first Grand Coulee machine came back on the line. Within a few minutes, all of the machines were returned to service. Normal conditions were restored as the steam plants backed away and interconnections were reclosed.

Review of this system disturbance shows that the primary cause was loss of the Grand Coulee house generator from accidental operation of its protective relay system when the swinging panel supporting the relay was jarred abnormally. Loss of the house unit automatically cut off the power supply of the exciter motor-generator sets connected individually to the main generators; and the out-of-step condition followed shortly thereafter. In addition, other conditions arose, such as the opening of the Spokane-Montana ties, which tended to prolong the restoration of system frequency to normal.

The Bonneville Power Administration, the Grand Coulee staff, and other agencies affected by the disturbance studied all the above incidents and others intensively. At Grand Coulee, for instance, the house generator relays have been moved to a more secure location, and further measures will no doubt be required, not only at Grand Coulee but elsewhere, to minimize the possibility of future system disturbances.

The Case of the INQUIRING LIGHTING SALES MANAGER

Chapter One: HE ASKS FLEUR-O-LIER SOME POINTED QUESTIONS

what are certified FLEUR-O-LIERS?

FLEUR-O-LIERS are fluorescent lighting fixtures made to exacting specifications, set up by lighting experts, for performance, construction and service.

what do you mean, "CERTIFIED"?

Fixtures built to the FLEUR-O-LIER specifications are submitted for testing and checking to independent experts, Electrical Testing Laboratories, Inc. If the fixtures meet all rigid specifications, they are permitted to bear the ETL CERTIFICATION LABEL, shown below.

Is FLEUR-O-LIER the brand name of <u>one</u> company?

Not at all! 27 leading fixture manufacturers participate in the FLEUR-O-LIER CERTIFICATION program at the present time, and the number is growing.

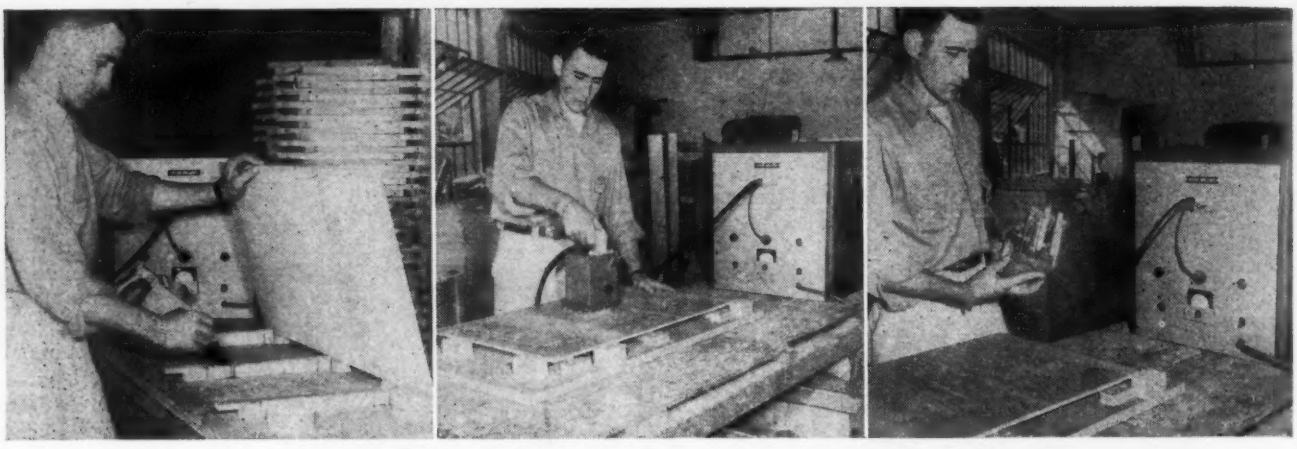
this label is your clue to good lighting fixtures!

It is your definite assurance of *electrical, mechanical and lighting excellence* in fluorescent lighting fixtures!

FLEUR·O·LIER *Manufacturers*

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of more than 30 leading fixture manufacturers. Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements.

LOAD BUILDING



DIELECTRIC glue-setting machine tacks reinforcing strips on furniture tops to save boring and use of screws. Reinforcing strips are placed in jig (at left) and spread with glue. Plywood veneered top is placed on strips and each strip is tacked in two places (center) leaving balance of glue to set normally as part goes through production line. Heat applying tool (right) has hand-operated variable condenser adjustment for thicknesses of wood up to 1 in.

Wood Welder Does Three Men's Work

A PRODUCTION TOOL to reduce costs is to be found in the Portland (Ore.) plant of the B. P. Johns Furniture Corp., in the form of the "Wood Welder" illustrated. This high-frequency dielectric heating device made by the Short Wave Plastic Forming Co., of Burbank, Calif., is used to set the urea resin glue on the reinforcing strips that are placed on the underside of tops for various pieces of furniture. The glue is set in only two spots on each strip to save the use of wood screws to hold the strips while the glue on the entire strip sets in its own natural time of three to four hours.

The 1-kw. diathermy unit shown is adjustable to penetrate $\frac{3}{16}$ in. up to 1 in. of wood thickness per second. Timing is adjustable for any length of heat application desired. This simple machine costing only $395 operates at about the material cost of the wood screws only that would otherwise be required. Thus the labor of boring holes and setting the screws is saved. Plant Superintendent George W. Krick states that one man with this machine does the work of three men using screws.

The same equipment is used as well for tacking on glued wood carvings on furniture, but Krick states these applications are only minor to what can be done in the way of edge gluing and other operations for which he is buying large equipment on the strength of the performance of the "Wood Welder."

•

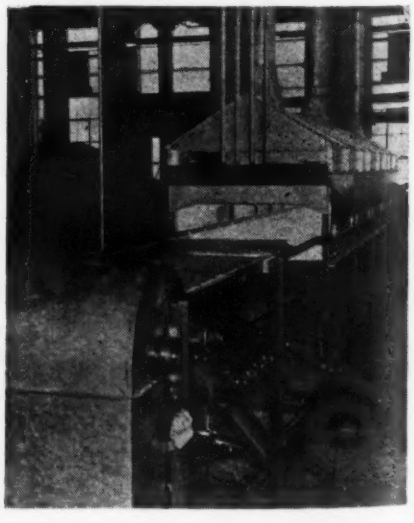
Cuts Drying Time From Days to Minutes

OPERATING daily in two 8-hr. shifts a 60-kw. infrared electric oven installed at the factory of The Wiremold Co., Hartford, Conn., has cut down the drying time of enameled metal components of the product from a former period of 4 to 5 days by air to about 7 minutes with the improved method. The oven contains 240 lamps rated at 250 watts each. The conveyor speed range is from 2.4 to 7 min. per 10 ft. of run, with four gradations available. Lamps are mounted 8.5 in. from material in process, and the conveyor has a section 10 ft. long for initial air drying, 20 ft. for infrared drying and 10 ft. long for cooling the product.

The auxiliary equipment includes motor drives aggregating about 2.5 hp. for the conveyor, a pump, and an exhaust fan of 500-cfm. capacity. The operating temperature of the infrared section approximates 375 F. In a typical hour's run about 6,000 Wiremold elbows can be handled, or other material in proportion.

Alternate rows of lamps can be cut

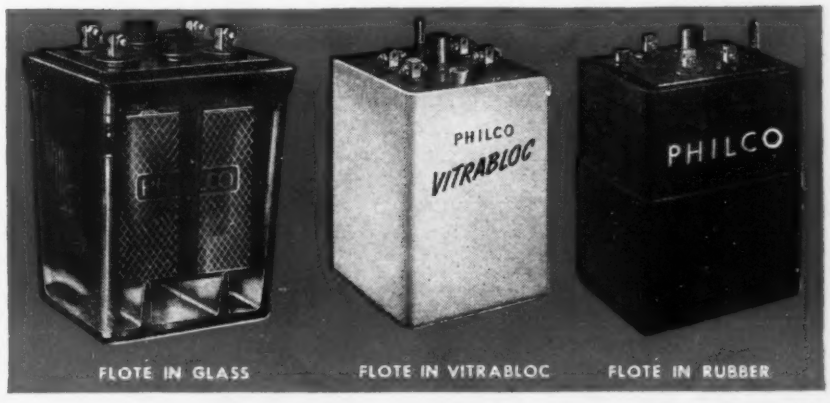
CLOSE-UP of 60-kw. oven in Wiremold plant with three exhaust outlets which discharge into a main duct leading outdoors. Lamps are automatically cut off if fan stops



Specify PHILCO

CONTROL BATTERIES

The way to be sure of getting these modern control batteries that are specifically engineered for today's full float service, is to name them in your specifications—PHILCO BATTERIES. Here's a long time investment that will provide extra satisfaction and low operating cost for years. The famous Philco Floté element, with grids cast in special metal, is the most efficient ever produced for modern utility requirements. Specify Philco Storage Batteries in glass, rubber or Vitrabloc. Write for latest specification data. PHILCO CORPORATION, Storage Battery Division, Trenton 7, New Jersey.



PHILCO

FOR FIFTY YEARS A LEADER IN
STORAGE BATTERY DEVELOPMENT

COMPLETE HOUSING AND LUBRICATION OF THREAD PREVENT CORROSION
Built for either hook or socket hot stick
V-Groove jaw construction assures 4-point contact
Spring of vanadium steel, stress-relief annealed after plating, assures permanent spring strength
Free sliding vise-type sleeve moves with spring
HEAVY COIL SPRING AUTOMATICALLY TAKES UP ANY VARIATION IN DIAMETER OF CONDUCTOR
FARGO

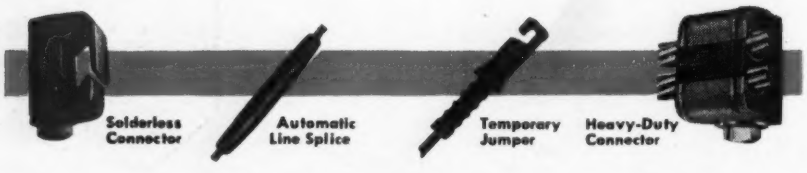
"Spring Action" hot line clamp

prevents loose contact arcing

Loose contact arcing can be eliminated. Investigation reveals that standard hot line clamps loosened and rotated on the conductor because of dimensional changes in the conductor due to temperature variations, vibration or the "relaxation" occurring in stranded conductors as a result of the heat from high fault currents. Fargo developed the AGE 1 "spring action" hot line clamp after thorough research and testing in the field to find a clamp that would stay on tight.

Helps reduce inventory

Bronze body of AGE 1 with special coating is suitable for both ACSR and Copper conductors and can be tapped to either metal. The clamp can be used on No. 6 solid up to and including 4/0 strand and #2 ACSR plus armor. For complete information see your Line Material Salesman or write Fargo Mfg. Company in Poughkeepsie, New York.



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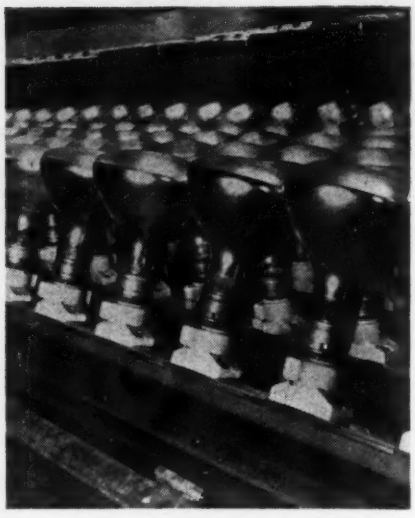
MFG. COMPANY, INC.

Poughkeepsie, N. Y.



DETAIL of 250-watt infrared lamp mounting in sockets carried by Wiremold raceways which facilitate flexible spacing of lamps to meet production conditions

out of circuit if desired, and in case the exhaust fan should shut down, the lamps are automatically cut out of service. The infrared section required 120 ft. of Wiremold No. 1,100 channel (6 rows of 20 ft. each) and 240 No. 1,126 sockets spaced on 6-in. centers. This facilitated adjusting for the correct angle for proper heat concentration. The ruggedness of the channel enabled the company to install the sockets on any desired centers, and the wiring used is No. 12 asbestos-covered, lamps being rated at 120 volts and installed in series pairs on 240-volt a.c. circuits, energy being purchased from the Hartford Electric Light Co. All wiring leads are inclosed and protected, and because of the inherent strength of steel raceways, a minimum of supporting structure is needed. Rearrangement of infrared lamps in future can be easily done with this construction.

•

Oklahoma Utility Office Newly Relighted

FIFTY FOOT-CANDLE illumination is furnished in the first floor office of the Oklahoma Gas & Electric Co., Oklahoma City, with 148 four-lamp fluorescent luminaires. The total area is 7,800 sq. ft., with an average load of 3.62 watts per square foot. Ceiling height of the room is 16 ft. 6 in.

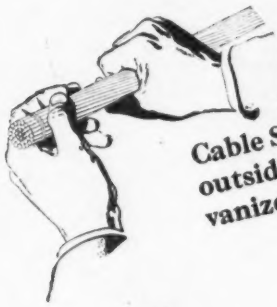
The ceiling is flat white and the efficiency of the installation is further enhanced by a light dull-finish mar-

A PRIMER ON

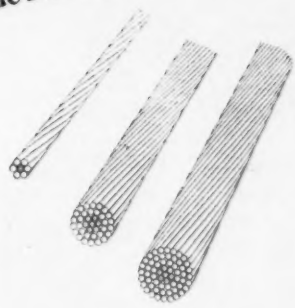
ALCOA A.C.S.R.

FOR NEWCOMERS

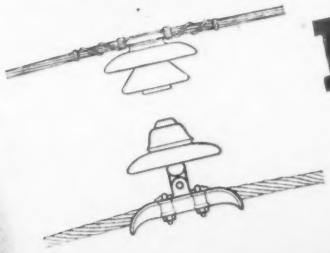
You old timers can pass up this page



A.C.S.R. means Aluminum Cable Steel Reinforced . . . aluminum wires on the outside for high electrical conductivity and galvanized steel wires on the inside for high strength.



Sizes suitable for every type of line are made in Alcoa A.C.S.R. . . . for rural feeder or tap lines, up to the largest transmission lines.



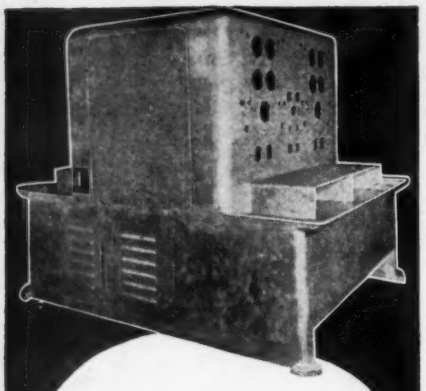
Long span construction is natural with Alcoa A. C. S. R. holding down first cost. Upkeep is low.

Advisory service is available to all who plan to use Alcoa A. C. S. R. on their lines . . . conductor sizes and strengths, permissible spans, stringing data, guidance on erection. Alcoa introduced A. C. S. R. in 1909, so this help is based on many years' experience.

Call the nearby Alcoa office for any data you need, or write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Bldg., Pittsburgh 19, Pa.

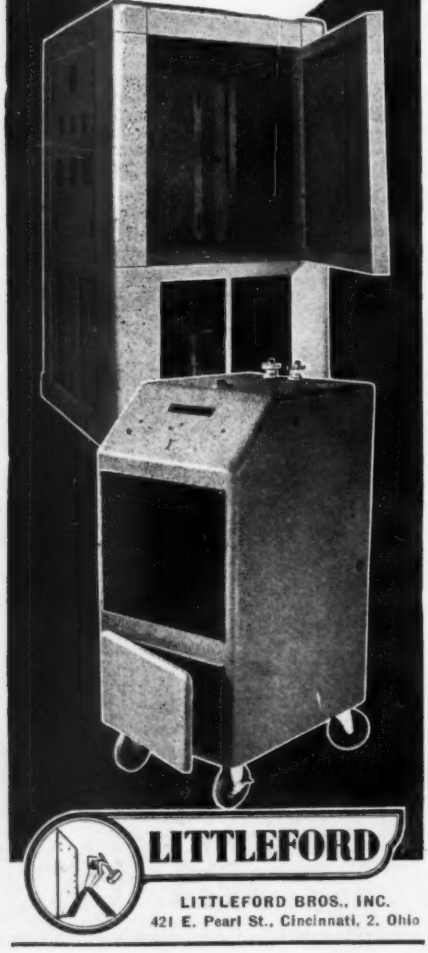
ALCOA A-C-S-R

ALUMINUM CABLE STEEL REINFORCED



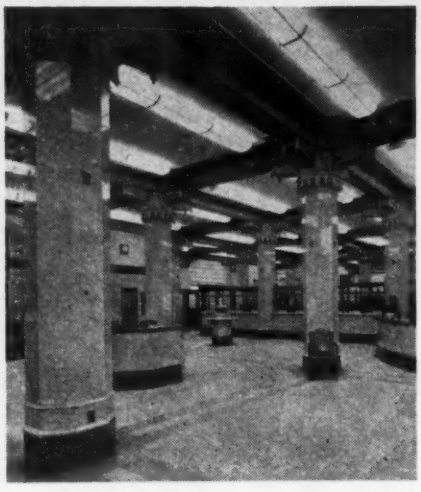
INSTRUMENT MOUNTING STRUCTURES

Producing of Cabinets, Panels, Control Boards, Steel Cubicles, require the most accurate fabrication of Plate and Sheet Steel. That is why Littleford is one of the foremost producers of this type of equipment—the exactness of Construction is the prime factor when fabricating Mounting Structures in Littleford's modern equipped plant. Send in blueprints if you have a problem and see how easy it can be handled, and at low cost too.



LITTLEFORD

LITTLEFORD BROS., INC.
421 E. Pearl St., Cincinnati, 2, Ohio



UTILITY OFFICE relighted to 50 foot-candles at 3.62 watts per sq. ft.

ble floor. The luminaires have bent glass panels on the sides, of rib design and specially treated for diffusion that permits only 30 percent light transmission.

Equipment was furnished by Solar Light Manufacturing Co., Chicago.

•

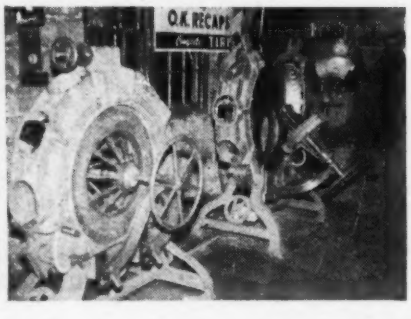
Electric Heat Cuts Tire Recapping Costs

RALPH A. POTTER
Power Sales Engineer
Northern Berkshire Gas Co.
North Adams, Mass.

THE MODERN SAW "There was an old kilowatt who lived in a shoe: before he was through he improved the shoe too," expresses in whimsical words the usefulness of electric service in the new tire repair shop of O. K. Rubber Welders, North Adams, Mass., a well equipped plant from the electrical viewpoint. The fine control and nice "tailoring" of electric heat usually brings about an improvement in processed products, and this is very much to the point in recapping tires. This plant utilizes a 5-hp. buffer motor; 2-hp. air compressor; two 4-kw. tire molds; a 0.5-kw. shoe vulcanizer; a 0.33-kw. side wall vulcanizer; and a 0.5-kw. tube vulcanizer. The total demand is about 10 kw., and 24-hr. service is rendered customers. The first tire recapped in a day calls for a 2-hr. preheating period.

In this shop the old tread is carefully buffed down to a substantial support for the new surface. After the cap has been cemented, the tire is baked in a mold for 70 min. A 3-ton pressure applied during baking forms the tread design and compresses the rubber. The denser tread gives more miles of driving and is guaranteed not to come off. It is estimated that an electric "recap" will deliver about 90 percent of new tire mileage. With electric heat only the tread area of the tire is heated, and the original strength of the side walls is not impaired. Some fleet owners have tires recapped four times before discarding. Stanley Wondoloski, owner of this shop, states that he averages about 200 tires a month, using about 1,300 kw.-hr. in that period. The electric cost is 33 cents per recap against 45 cents with steam.

TIRE REPAIR shop of O. K. Rubber Welders in North Adams, Mass., operates 24 hours a day and is fully electrified. Each tire mold has a 4-kw. heating element



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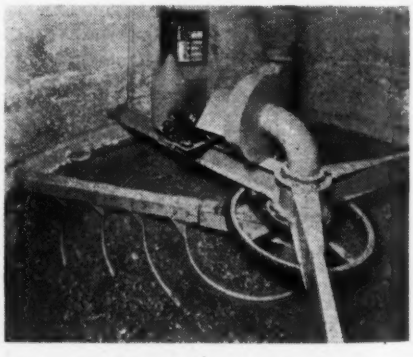
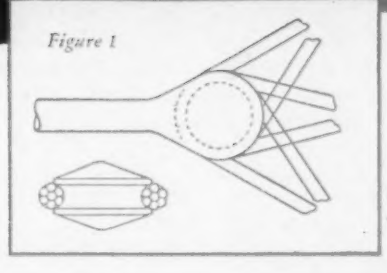
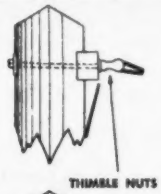
Silage Pick-Up

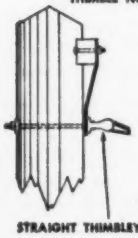


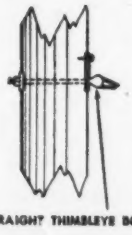
PITCHING silage by hand has been eliminated by this device installed in a silo on one of the farms served by the Wisconsin Power & Light Co. The 2-hp. motor, shown mounted on a framework suspended by cables from the top of the silo, drives a sweep that moves the silage toward the center of the silo where it is picked up by blower and discharged into a cart on the floor of the silo room. A time clock shuts off the motor when the required amount of silage has been discharged

The New CHANCE THIMBLEYE gives complete strand protection



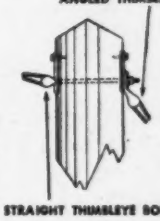

THIMBLE NUTS


STRAIGHT THIMBLEYES


STRAIGHT THIMBLEYE BOLTS

STRAIGHT THIMBLEYES

ANGLED THIMBLEYES


STRAIGHT THIMBLEYE BOLTS

ANGLED THIMBLEYES

Chance Thimbleye Guying Fixtures have been redesigned to give added protection to guy strands at varied angles of pull, thereby minimizing hazards to line security caused by kinked, distorted, or broken strands. The improved eye forms a perfectly shaped "thimble" at all angles as the strand groove extends all the way around to form a complete circle. (See Figure 1.) The sidewalls of this groove are formed to fit snugly around the guy strand. This new design keeps the strand from flattening under tension, preserves its cylindrical shape and prevents it from kinking at any one point.

Chance Thimbleye Guying Fixtures are made in a variety of types for every installation. Used singly or in combinations, as suggested by the sketches on either side, they are easily applied and make up guys that can be depended upon for many years of service.

To get the most out of anchoring, always specify Chance Thimbleye Guying Fixture and Thimbleye, Twineye or Tripleye Anchor Rods and get these latest improvements. Order through your regular source of supply.

C469

A·B·CHANCE CO· CENTRALIA, MO.
SAN FRANCISCO, CALIFORNIA

ABC INDUSTRIES

CHANCE IMPROVED THIMBLEYES ARE ALSO MANUFACTURED AND DISTRIBUTED BY THESE LICENSEES:

Jodyn Mfg. & Supply Co., Chicago, Ill.
Line Material Co. . . . Milwaukee, Wis.
Oliver Iron & Steel Corp. Pittsburgh, Pa.
Kerlick Mfg. Co., San Francisco, Cal.
Seyler Mfg. Co. . . . Pittsburgh, Pa.
H. Slater Company, Ltd. Hamilton, Ontario

NEW EQUIPMENT

Photoelectric Controls Usable in Limited Space

SERIES 20 and 21 photoelectric controls recently introduced by Photoswitch Inc., 77 Broadway, Cambridge 42, Mass., are designed for general industrial and machinery application. They are applicable to such applications as counting, conveyor control, short-range signal systems, motor or valve control, production inspection, machinery safeguards, stop-motion control in textile paper and wire industries, as well as automatic control of specialized industrial processes.

The phototube, which must be located at the point where operations are being observed, is available either with the housing or in a small separate housing. The latter permits the use of the control where space is limited. A tamper-proof sensitivity adjustment is provided on the control housing to permit positive operation over varying distances between the phototube and the light source. Simplicity is obtained by having a single set of terminal board connections in the control to provide the supply current for the light source.

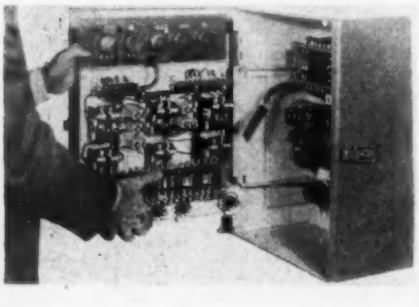
Units are moisture proof and designed to operate in high-temperature areas. Hermetically sealed, oil-filled condensers and high wattage resistors are utilized. The controls have an operating range of 20 ft., provide for relay operation at any predetermined

level of illumination within the 10- to 50-foot-candle range, operate from either 115- or 230-volt supply, and have a maximum rating of 10 amp., 115 v.a.c., 5 amp., 230 v.a.c., non-inductive ½ hp., 115/230 v.a.c. with both poles in parallel.

• • •

Welding Timer Redesign Saves Operator's Time

THE REDESIGN of its complete line of sequence and sequence-weld timers for resistance welding permits quick change of the welding sequence, easy inspection and maintenance, and remote operation, the General Electric Co., Schenectady 5, N. Y., developers report. It includes an improved electronic timing circuit which makes possible the consistent welding speed essential to high-production welding with short timing intervals.



The sequence timer coordinates the mechanical operation of an air- or fluid-operated spot or projection welder with the flow of welding current, as determined by a synchronous-precision weld timer. For less exacting applications, the sequence-weld timer provides the necessary control of both mechanical sequence of operation and non-synchronous control of weld time. Both can be used with all standard control combinations in which ignitron contactors or synchronous-precision timers are used.

All electrical connections between the front and rear panels are made by plug connectors so that the front panel, or timing control section, can be removed in less than a minute and placed in another machine. This permits quickly replacing any one of a number of similar timing control sections with a single spare unit. In addition, timing control sections of different types can be interchanged without rewiring.

Features reported are simplified routine inspection and servicing including a completely redesigned wiring system in which most of the small resistors and capacitors are mounted on a terminal board; use of standard industrial-type relays which are familiar to electricians; and a hinged front panel which cuts inspection time. For the convenience of the operator, the timing control station can be mounted on the welding machine or elsewhere, as it is detachable from the front panel.

The initiating circuit, normally 115 volts, can be easily changed to 24 volts, and a two-stage foot-switch can be added at any time. All 60-cycle panels are suitable for operation on 208, 230, 460, or 575 volts, 50 or 60 cycles, and panels are available for other frequencies.

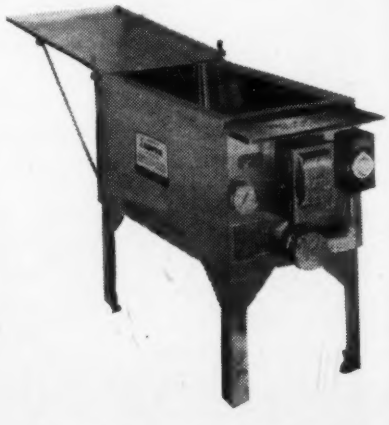
•

Electrically Heated Tanks For Wax Use Improved

AN IMPROVED line of thermostatically controlled, electrically heated dipping tanks for use with various waxes has been announced by D. C. Cooper Co., 1467 S. Michigan Ave., Chicago 5, Ill.

The tanks are made of steel, all welded construction, and have 2½ in. of insulation on four sides and bottom. Strip heaters are placed on the bottom between the inner and outer shells.

Units are available in 5 to 300-gal.



MATERIAL Builds Extra Safety and Into L-M Distribution Capacitors

The real heart of a Capacitor is the "pack," made by winding together thousands of yards of special thin Kraft insulating tissue with pure aluminum foil.

Low Unit Stress Means Long Life

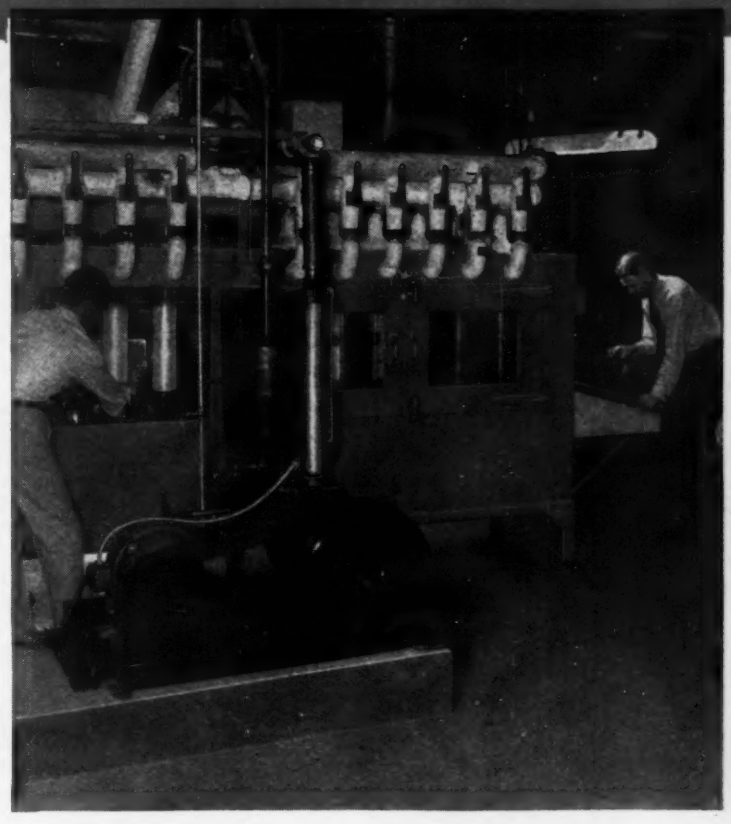
Line Material Capacitors are given extra working ability and assurance against failure. Between each pair of foil plates are extra sheets of insulating paper of finest quality. This additional insulation gives each L-M Capacitor, for its rated capacity, a much higher than usual margin of safety against breakdown.

Wrapped Major Insulation Eliminates Weak Spots

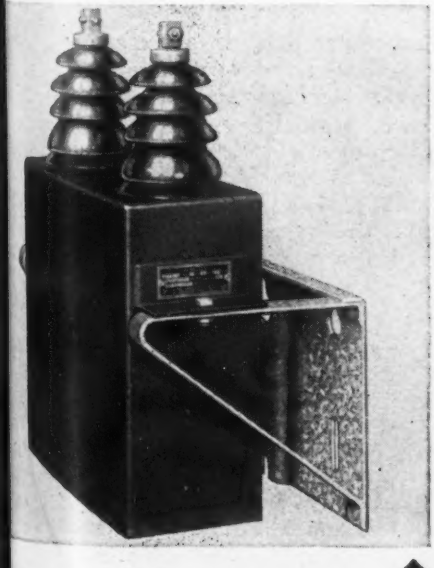
Completed packs are also enclosed in multiple layers of heavy Kraft "major insulation" paper, ingeniously assembled to assure a complete cover, and are held rigidly in place within the sheet steel tank.

Capacitors Must Be Kept Super-Clean

Line Material Capacitors are made of the finest materials obtainable. Also they are assembled under controlled atmospheric conditions. The air in the glass-brick-enclosed department is kept free from dust, so that no foreign particles can get into the packs. The insulating paper, stored and wound at the same temperature and humidity at which it was manufactured, forms packs that are free from unevenness due to variations in moisture content.



View of a Line Material exclusive drying and impregnating oven, in which L-M Capacitors have air and moisture removed to a high degree, and then are filled with Elemex liquid by "capillary impregnation," in one continuous process.



Exterior view of L-M 2,400-volt Capacitor attached to NEMA standard hanger, which permits mounting directly on the pole, on a standard cross arm, or on a wall.

"Capillary Impregnation" Makes Voidless Dielectric Media

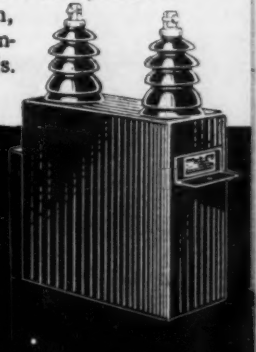
Under L-M's exclusive method, each unit is individually dried, under high vacuum and controlled heat, to produce a very high degree of moisture removal. During the process constant electrical efficiency tests are made of each individual unit. These tests determine the most opportune time for impregnation. Then each unit is impregnated with "Elemex" insulating liquid while still under high vacuum. The liquid is fed to the bottom of the pack and allowed to rise slowly by capillary action, so that it permeates every fibre of the paper. This method of "capillary impregnation" prevents the possibility of trapped air pockets anywhere within the unit. When electrical measurements show that impregnation is complete, the tank is entirely filled with liquid and quickly sealed off to prevent any contamination.

"Elemex" Highly Stable and Noninflammable

"Elemex" is an ideal dielectric liquid developed by L-M chemists. It is extremely stable, with negligible electric losses and high dielectric constant and strength. Noninflammable. Has no affinity for moisture.

Standards and Sizes

These Capacitors meet all AIEE-NEMA standards for outdoor Capacitors with respect to voltage rating, KVA, losses, bushing flashover, over-voltage test, insulation strength, radio noise, heating and discharge resistors. They are now produced in sizes 2,400 to 13,800 volts, 15KVA. For further information, address Line Material Company, Milwaukee 1, Wis.

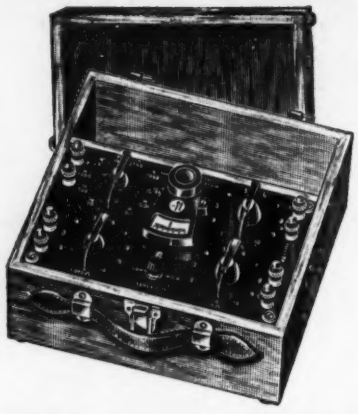


LINE MATERIAL
CAPACITORS

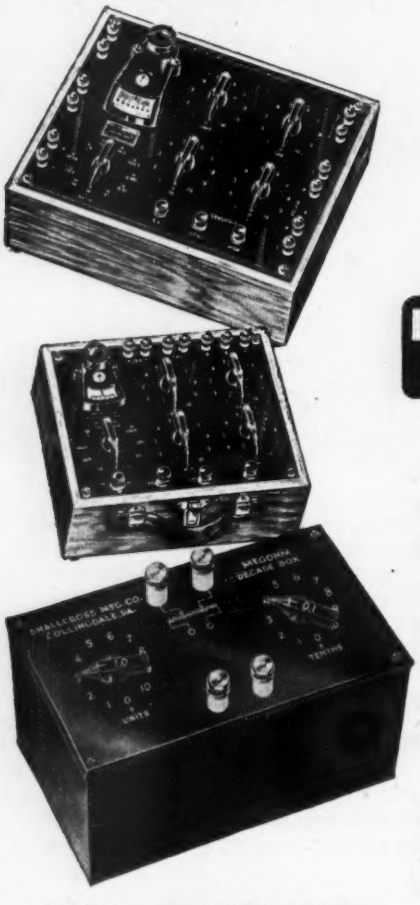
L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street and Airport Lighting Equipment • Wired Radio Control Equipment • Capacitors

TYPICAL!

The Shallcross Type 637 Bridge combines both the Kelvin and Wheatstone circuits in a single portable and durable instrument. Provides a resistance measurement range from .001 ohms to 11.10 megohms. List price $100.



YOU DON'T HAVE TO CODDLE SHALLCROSS INSTRUMENTS



LOW PRICED

RUGGED

ACCURATE

EASILY REPAIRED IN CASE OF MISUSE

Shallcross Test Instruments are built for hard, frequent use on any job — for production line, field, school or laboratory service. No need to worry about how or by whom they are used. They're rugged and dependable. In case of misuse, repairs are usually made locally.

These instruments are accurate for every commercial and most laboratory needs. Available in types, sizes and ranges for every testing need — at prices to make their regular use practical.

Write for engineering bulletins on any type.

BRIDGES — RESISTANCE STANDARDS
FAULT LOCATION BRIDGES
DECADE POTENTIOMETERS
HIGH-VOLTAGE TEST EQUIPMENT, etc.

SHALLCROSS MANUFACTURING COMPANY
Dept. EW-106, Jackson & Pusey Aves., Collingdale, Pa.

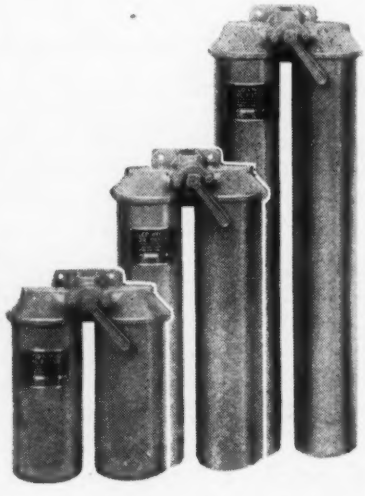
SHALLCROSS Electrical Measuring Instruments • AKRA-OHM Resistors • Precision Switches • Electronic Engineering

capacity sizes. They are usable on 110- and 220-volt circuits and have a maximum demand commensurate with the wax capacity.

•

Diesel Fuel Oil Filters For 10,000-Hp. Units

THREE new sizes of fuel oil filters, for bracket mounting to Diesel engines, have been added to the Hilliard Corp., Elmira, N. Y., line of lubricating and fuel oil filtering equipment. The size units available make it possible to cover engines ranging from 200 hp. to 10,000 hp. in size. The duplex operation permits an uninterrupted flow of fuel to the engine. By turning the valve control handle, the flow of oil is thereby directed from one side of the filter to the other.



Features reported by the manufacturer include made-up type, throw-away filter cartridges with gaskets attached. Filtering material is a specially processed cellulose of uniform density and so packed as to avoid the possibility of channeling, and filter cartridges are all metal covered to avoid the possibility of migration of any filtering material.

•

New Potentiometer Saves Space and Weight

A NEW POTENTIOMETER, which is a linear, wire-wound resistor of the helical type and which is designed for flight test and allied instrumentation work where weight and size are primary considerations, has been announced by the Van Dyke Instrument Co., Tarzana, Calif.

The resistance element consists of a special alloy core over which is wound a single layer of low temperature coefficient resistance wire. Linearity of the completed resistance is maintained by electronic control during the wind-

"I'm all over the map at once"

"IT certainly keeps me on the go . . . my job of distributing equipment and supplies to the Bell Telephone companies throughout the nation.

"Right now I'm busier than ever. . . delivering telephones, switchboards, cable and countless other kinds of apparatus and supplies. They're all needed for the Bell System's construction program of more than $2,000,000,000 . . . to give you better-than-ever telephone service.

"I maintain 29 distributing houses at strategic locations, where I keep some 10,000 different items in stock . . . and where I also repair telephone equipment.

"And that's only part of my job. I'm *manufacturer* and *purchaser* for the Bell System . . . and I *install* central office equipment.

"Remember my name. . .

"It's Western Electric."

MANUFACTURER... of 43,000 varieties of telephone apparatus.

PURCHASER... of supplies of all kinds for telephone companies.

DISTRIBUTOR... of telephone apparatus and supplies.

INSTALLER... of telephone central office equipment.

FOR THE BELL SYSTEM

Western Electric

PRITCHARD
offers the KEY to
HIGHER PROFITS—
LOW-COST
POWER

Benefit from our broad experience in the design, engineering and construction of UTILITY and INDUSTRIAL POWER PLANTS, either complete new stations or additions and alterations. Any part of our comprehensive service is available separately.

POWER DIVISION • FIDELITY BLDG. • KANSAS CITY, MO.

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS

for the CHEMICAL • PETROLEUM • GAS and POWER industries

HOUSTON, TULSA, PITTSBURGH, CHICAGO, NEW YORK, DETROIT, ATLANTA, DENVER, SALT LAKE CITY, EL PASO, OMAHA, LOS ANGELES, MEXICO CITY, ST. LOUIS, MINNEAPOLIS

ing process. The resistance thus wound is formed into a helix and bonded within an aluminum housing.

A wiper contact rotates around the inside of the helix on a lead screw. Positive stops are provided and all terminals are brought out through the rear of the case. Contact parts and terminals are silver plated.

Resistance values up to 6,000 ohms per turn can be supplied. Power rating is 1.5 watts at 55 deg. C. The 10-turn unit has 3,600-deg. rotation, a body length of 1⅞ in., and a diameter of 1 in.

•

Filter Cartridge Ends Possibility of Channeling

A NEW filter cartridge, type FHC, which is made of a specially processed cellulose material offering uniform

density and so packed to eliminate the possibility of channeling, has been announced by the Hilliard Corp., 102 West Fourth St., Elmira, N. Y.

The filter material use is reported as suitable for filtering both the straight-run mineral oils and the heavy-duty detergent oils. Features of the cartridge are outlined in the illustration.

•

Bridge Measures Resistance, Capacitance in Six Ranges

A NEW resistance-capacitance bridge, Model 76, which is a general-utility instrument, is being announced by Aerovox Corp., New Bedford, Mass. It is reported as suitable for use in the shop or laboratory or out on the job.

The bridge measures capacitance from 100 mmf. to 200 mfd. in six ranges; measures resistance from 10 ohms to 200 megohms in six ranges; measures power factor from 0 to 50 percent; provides d.c. polarizing potential for leakage measurements for 0 to 600

We build towers
of EVERY TYPE
Need transmission towers? Substations? Radio towers? Floodlight towers? Even a power windmill or memorial tower? Whatever your tower requirements, American Bridge Company has unequalled facilities and engineering experience to do the job right. It will pay you to send us your inquiries.
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LONG LIFE DOUGLAS FIR POLES

BAXCO Long-Life Douglas Fir poles are pressure treated and stocked at three strategically located plants. *Shipments direct from the timber producing country of Oregon are being made to Mid-West and Eastern buyers from the new pressure creosoting plant of J. H. Baxter & Co. of Oregon at Eugene, Oregon. *Two large pressure treating plants and storage yards are operated by J. H. Baxter & Co. at Alameda and Long Beach, California. Facilities are available at our California plants for both rail and water shipment via San Francisco and Los Angeles Harbors. Cargo shipments are also made through the Port of Portland, Oregon.

BAXCO Long-Life Douglas Fir poles meet ASA Specifications and are pressure-treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

J. H. Baxter & Co.

333 MONTGOMERY STREET · SAN FRANCISCO 4, CALIFORNIA
LOS ANGELES · LONG BEACH · ALAMEDA · CALIFORNIA, U. S. A.

volts, d.c., continuously variable and calibrated in volts; and checks leakage or insulation resistance in terms of "good," "fair," or "bad."

Accuracy of the unit is reported as due to the 4-in. diameter dial with the same calibrated and linear scale for all functions. This is said to prevent crowding at the high end and make for easier reading. The "magic eye" null indicator is provided for balancing.

TECHNICAL LITERATURE

Powdered Metal—Revision of the standard for the Tentative Method for Sieve Analysis of Granular Metal Powders (No. 5-46T), which supersedes the June, 1945, issue, is available from the Metal Powder Association, 420 Lexington Ave., New York 17, N. Y., for 10 cents per copy.

Copper Sheets—A new technical bulletin entitled "Investigation of the Strength of Riveted Joints in Copper Sheets," No. 360, is available from the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Welded Structures—How the combination of low ductility and high residual stress affects the load carrying capacity of welded points connecting steel plates is the problem considered in the new bulletin "Residual Stresses in Welded Structures." This publication, No. 361, is available from the Engineering Experiment Station, University of Illinois, Urbana, Ill.

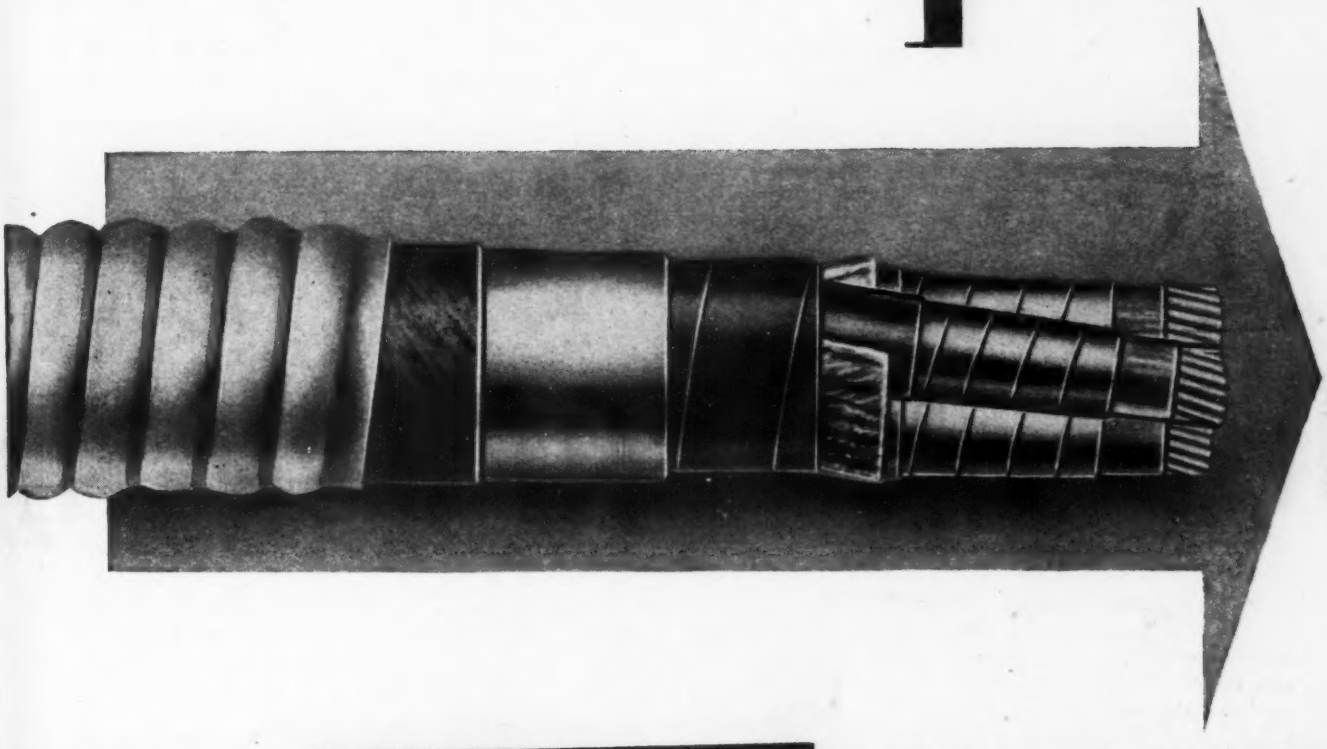
Clay Bonding—"The Bonding Action of Clays, Part 2, Clays in Dry Molding Sands," is the title of the new clay bulletin available from the Engineering Experiment Station, University of Illinois, Urbana, Ill. The new bulletin, No. 362, continues the studies reported in No. 357, which is entitled "Part 1, Clays in Green Molding Sands."

Water Heaters—"Model Specifications for the Installation of Wiring and Plumbing for Automatic Electric Storage Water Heaters" has been released by Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. The publication, No. 0-4, is available for 25 cents per copy. It is designed to aid electric operating utilities in preparing their own wiring and plumbing installations.

Varnished Cloth—Black and Yellow Straight Cut Varnished Cloth Standards, publication No. 45-110, is available from National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y., for 25 cents per copy. It covers varnished cloth in sheet form, 5, 7, 10, 12, 15 mils in thickness, which is to be used as an electrical insulation between metal parts in electrical apparatus.

Mineral Wool—A new Commercial Standard, CS131-46, entitled "Industrial Mineral Wool Products, All Types—Testing and Reporting," is available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10 cents per copy. The standard provides uniform methods for testing and reporting the physical and chemical properties of mineral wool products made of rock, slag, or glass and describes equipment required to produce standard results. Methods of test are included for adhesive strength, compressive strength, corrosion resistance, coverage, density, fire resistance, moisture absorption, odor emission, shot content, temperature stability, and thermal conductivity.

headed for a hot spot



THERE'S A DELTABESTON* HEAT-RESISTANT CABLE TO MEET CONDITIONS IN YOUR PLANT

Here's a multiple-conductor cable that has solved its own housing problem. Specially designed to meet unusual conditions of temperature and humidity in a large industrial plant, its highly resistant lead sheath is encased in an interlocking steel armor which serves as a conduit for the cable. It was built to be tough and, at the same time, to maintain the safety factor so necessary for plant efficiency.

Deltabeston cables have proved their worth through years of practical service on heat-resistant jobs in G-E plants and products. And this *usage-experience* can prove valuable in helping to solve your own cable problems.

If you're looking for the extra assurance of dependability and service that Deltabeston can give—or if you need a special heat-resistant cable such as the one pictured here to do a particular job, your Deltabeston distributor is ready to help you meet these specifications and to provide advice that will forestall emergencies.

For a copy of the Deltabeston Cable catalog, write Section Y17-109, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut. Deltabeston Wires and Cables are distributed by General Electric Merchandise Distributors.

*Trade-mark Reg. U.S. Pat. Off.

GENERAL ELECTRIC

NEWS ABOUT PEOPLE

Virginias Utilities Group Names Leatham President

Charles H. Leatham, vice-president of the Monongahela Power Co., Fairmont, W. Va., has been elected president of

C. H. LEATHAM

the Public Utilities Association of the Virginias.

Mr. Leatham has been active in promoting rural electrification and for six years prior to July 1 last, was chairman of the rural committee of the Edison Electric Institute. In 1908, when 19 years of age, he entered the employ of the West Penn Power Co. as an engineer at Uniontown, Pa., and three years later joined the commercial staff of the predecessor company to Potomac Edison Electric Co. He continued in that work until 1919 when he identified himself with another Potomac Edison affiliate, the Hagerstown and Frederick Railway Co.

After 14 years in that work he went to the West Penn Electric properties in Pittsburgh to do special research and two years later, in 1935, he became assistant general sales manager of the Monongahela West Penn Public Service Co. in Fairmont. He moved along rapidly, becoming commercial manager in 1937 and, after a few months, rose to the vice-presidency in charge of sales and operations.

•

► LOUIS J. REHBERG has been appointed superintendent of the Marysville power plant of the Detroit Edison Co. to succeed ALBERT E. LAURIE, retired. Formerly assistant superintendent at Marysville, Mr. Rehberg joined the Detroit utility in 1909 shortly after graduation from the University of Michigan.

•

Way Joins A.B. Chance As General Sales Manager

Kenneth R. Way, for the past ten years associated with the Line Material Co., Milwaukee, as assistant to the vice-president in charge of sales, has recently joined the A. B. Chance Co., Centralia, Mo., as general sales manager.

Mr. Way fills the vacancy left by J. T. Isbell, who moved to San Francisco

K. R. WAY

last summer, to become vice-president and Pacific Coast manager of the company's recently acquired switch division.

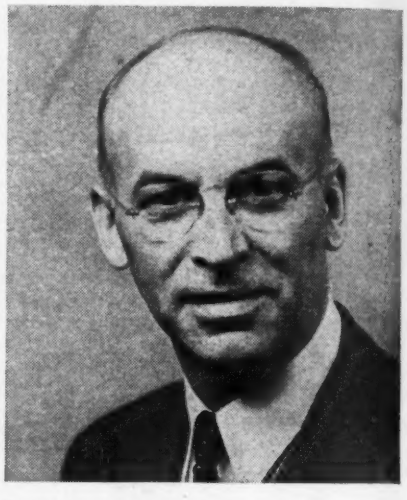
•

► EARL P. COX, who has been identified with the Ohio Public Service Co. for 26 years, has been named superintendent of production at the Mahoningside generating station, succeeding the late C. H. Byers. Mr. Cox received special company recognition in 1944 for his design for a new type condenser tube cleaning "gun" which was not only much more efficient than the type then in use, but also much easier to handle.

L. D. Riley Made Manager of Chester County Utility

Lewis D. Riley has been appointed manager of the Chester County Light & Power Co., Philadelphia, to succeed the late Jesse F. Potts.

Mr. Riley's wide experience in the



L. D. RILEY

utility industry, covering a period of almost 35 years, has included assignments in electric construction work, substation operation, power dispatching and electric metering.

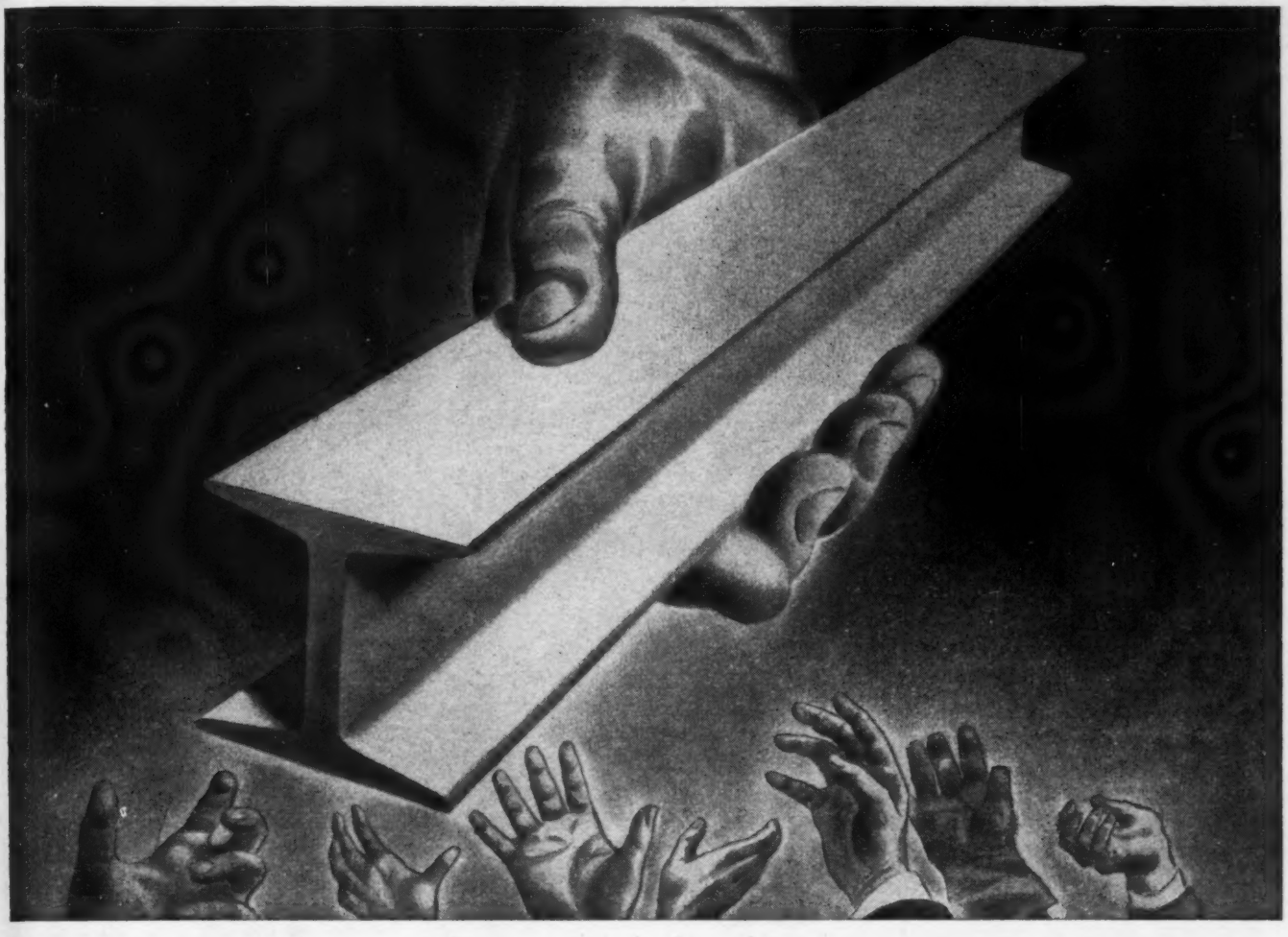
•

► D. H. ZILLMAN has been appointed electric distribution engineer with the Northern States Power Co. with headquarters in Eau Claire, Wis.

► ALLAN B. DAWSON has been appointed merchandise sales manager for the Lowell Electric Light Corp., Lowell, Mass. Mr. Dawson has been connected with the Lowell utility since 1927.

► JOHN T. CALLAHAN has been appointed safety supervisor in the operating department of the Delaware Power & Light Co., Wilmington, Del. Mr. Callahan has been identified with the Delaware utility since 1925.

► W. C. LOUNSBURY, JR., formerly manager of the lighting department of the Lake Superior District Power Co., Ashland, Wis., has joined the lighting division sales department of Sylvania



Brother, can you spare a beam?

Steel is like money. When you need it, you need it *badly*. That's why we have many steel plants to give next-door service most anywhere.

But lately it's getting so we hesitate to open the mail or answer the phone. We *know* there will be friends asking for steel—steel they need badly—and often we just are not able to fill the bill.

And here's what's causing it all

For a while it looked as though production would soon catch up with demand. Now that time seems more distant. The many things holding up top steel production have been slow to clear away. Unpredictable stoppages keep popping up, and shortages have brought other delays. You know about many of them. We've been doing our best, but for reasons beyond our control, we're still getting orders we can't fill.

But remember this:

One of these years the steel situation is going to change for the better. When that happens our plants will be among the first to stock products now hard to get and we'll burn up the roads rushing your steel to you. In preparation for that day, we're improving and expanding facilities, to protect the quality of Ryerson steel and ship it to you faster.

We are even now building a new plant and adding extensively to equipment at 11 others.

Meanwhile, the steel you need or a practical alternate may be in stock. So contact the nearest Ryerson plant with the full knowledge that we will do everything in our power to work with you.

JOSEPH T. RYERSON & SON, Inc., Steel-Service Plants at: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston

RYERSON STEEL

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

Crapo Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo Steel Conductors

Electric Products Inc., with offices in Chicago. Mr. Lounsbury is a former president of the Wisconsin Utilities Association.

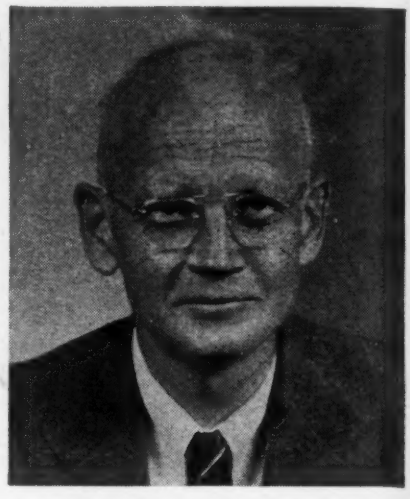
▶ FRANK MACMILLEN, New York newspaper man, has joined the staff of the American Standards Association as director of information. Mr. MacMillen, who resigned from the staff of *The New York Times* to take his present position, previously was connected for ten years with the Associated Press as financial news editor, in which capacity he first came in contact with the work of the Association. Mr. MacMillen will supervise an expanded educational program, designed to inform the public and interested industrial and technical groups concerning the activities of the association.

▶ LT. COL. JAMES F. TUOHEY, veteran employee of Arkansas Power & Light Co., has been named industrial engineer in the new industrial development department. His duties will include assisting county development committees to make surveys and perfect plans for industrial developments of local and outside capital. Mr. Tuohey started to work for Arkansas Power & Light in 1931 as substation operator. After a period in the meter department, he went into the sales department, becoming commercial sales manager. He resigned from this position in 1942 to enter the Chemical Warfare Service, stationed at Pine Bluff Arsenal. He was named head of the utilities branch of the engineering and services division, having charge of the electric, water, gas, steam, air, railroad and sewer systems at the military installation.

▶ JOHN L. KILPATRICK, formerly manager of sales and engineering for the Philadelphia Electric Manufacturing Co., has been appointed manager of the lighting sales department of Jersey Central Power & Light Co., Asbury Park, N. J. Mr. Kilpatrick worked for many years in both the lighting and lamp divisions of Westinghouse and it was because of his background and experience that he was selected by the U. S. Government to investigate German developments in this field. With the rank of colonel, Mr. Kilpatrick was the illumination member of the technical intelligence branch of government activities, and as such, spent several months in the European theatre. Active on several national committees of the Illuminating Engineering Society, Mr. Kilpatrick is a member of the U. S. National Committee of the International Commission on Illumination. He is also retained by the U. S. Department of Commerce as scientific consultant on illumination.

Reclamation Bureau Sends Newcomer to Venezuela

Albert W. Newcomer, engineer in the branch of design and construction at the Denver office of the Bureau of Reclamation, has gone to Venezuela where he will spend a year recommending



A. W. NEWCOMER

reclamation practices and techniques. He will investigate suitable locations for reservoirs and other construction for irrigation, flood control and hydro power. Mr. Newcomer will serve as consultant to the Venezuelan government, and will be assisted by a staff of Venezuelan engineers.

In a conference with Bureau of Reclamation officials, Pedro I. Aquerrevere, financial counselor of the Venezuelan embassy, explained that his country is now engaged in long-range planning to develop its agricultural resources.

Mr. Newcomer has been with the Bureau of Reclamation for twelve years.

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▶ WILLIAM L. BATT, president of the S.K.F. Industries, Inc., Philadelphia, received the War Department's medal for merit from Secretary of War Robert P. Patterson for "outstanding services" in the war effort.

▶ DR. CLIFFORD C. PATERSON, director of the research laboratories of the General Electric Co., Ltd., has recently been knighted. Dr. Paterson was president of the International Commission on Illumination when it met in the United States and has since been honorary secretary.

▶ HENRY C. TURNER, founder and chairman of the board of the Turner Construction Co., New York, has retired from the chairmanship. J. ARCHER TURNER, president of the company since 1941, has been chosen his successor and will continue as senior executive officer of the company. ADMIRAL BEN

VARIACS

for High Power

With the Type 50-A or Type 50-B VARIAC quite large currents for high power operation can be handled safely and conveniently. The **Type 50-A** VARIAC is rated at 5 kva; its rated output current is 40 amperes, with a maximum of 45; its output voltage is continuously adjustable from zero to a maximum of either 135 or 115 volts from a 115-volt line **(Price: $116)**

The **Type 50-B** designed for 230-volt input, may be used on a 115-volt line. With 230-volt input it is rated at 7 kva with a rated current of 20 amperes and a maximum of 31. With 115 volts across one-half of the winding, the ratings are reduced to one-half of these values. The output voltages are zero to either 270 or 230 volts. **(Price: $116)**

Two Type 50-A's ganged, with their windings connected in parallel and with a suitable choke, are rated at 10 kva with rated and maximum currents of 80 and 90 amperes respectively. The ganged assembly is the **Type 50-AG2. (Price** with one Type 50-P1 Choke: **$268.50)**

Two Type 50-B's, when similarly used on 230-volts are rated at 14 kva with 40 and 62 ampere current ratings. This assembly is the **Type 50-BG2. (Price**, with one Type 50-P1 Choke: **$268.50)**

With two or three Type 50 VARIACS a number of 3-phase connections are possible. Various powers up to 25 kva can be handled.

These larger VARIACS are proving indispensible in hundreds of uses where the economical operation, convenient rotary control, excellent regulation and high efficiency of the VARIAC is desired to vary continuously the current on any high-power a-c operated machine or device.

NOTE: WE HAVE A FEW OF THE SINGLE TYPE 50-A AND 50-B VARIACS IN STOCK FOR IMMEDIATE SHIPMENT

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PLAY SAFE!
Pull Fuses With
TRICO
FUSE PULLERS!
Here's cheap insurance against avoidable accidents when pulling and replacing fuses, handling live electrical parts, adjusting fuse clips, etc.

Every electrician, tool kit, switch and fuse box should have one. One accident can cost you more than all the TRICO FUSE PULLERS you need throughout your plant.
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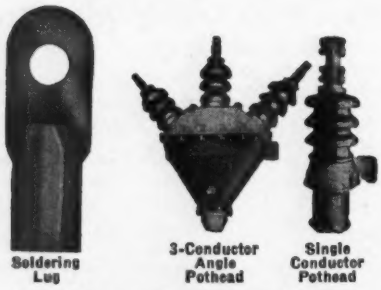
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Write for a complete selection of RUSGREEN bulletins
ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS
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14260 Birwood Avenue • Detroit, Mich.

MOREEL, retiring from active service in the Navy, has been elected to the position of president and a member of the board.

▶ DOUGLAS C. LYNCH has been appointed assistant general manager of the Westinghouse Electric International Co. Associated with the company in New York and abroad since 1937, Mr. Lynch recently returned from a Westinghouse mission to the Near East, where he was in charge of an airport survey in Turkey and conducted other company business in Egypt. Mr. Lynch will be succeeded as manager of the special projects department by ROBERT RUSSELL, formerly assistant manager of the department. Mr. Russell joined the Westinghouse Electric Corp. at its Mansfield, Ohio, plant in 1933.

▶ JAMES R. REED has been named manager of the commercial research department of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Reed, who attended the University of Wisconsin, has been with Allis-Chalmers in a statistical capacity since 1941.

▶ GEORGE C. CONNOR has been appointed general sales manager of the electronics division of Sylvania Electric Products Inc. Mr. Connor, who has been with Sylvania since 1934, will be responsible to Robert H. Bishop, director of sales, for the merchandising and sale of electronic products made at the company's electronic plants at Boston, Mass., and Williamsport, Pa.

▶ ALBERT T. BERGERON has been appointed sales manager of the illuminating division, The Miller Co. of Meriden, Conn., to succeed the late Arthur Miller, vice-president in charge of sales. His headquarters will be at the Meriden plant. Mr. Bergeron has been connected with the Miller sales organization for 21 years.

▶ WILLIAM G. ARNOLD, superintendent of the General Electric Co.'s turbine factory at Fitchburg, Mass., for the past year, has been appointed plant manager.

OBITUARY

▶ GEORGE B. CORNELL, chief engineer of the Westchester Lighting Co. and the Yonkers Electric Light & Power Co. when he retired because of ill health last year, died in Orlando, Fla., on October 13 at the age of 64. Mr. Cornell entered the employ of the New York Edison Co. in 1905 and two years later was transferred to the Yonkers company, where he was general super-

Conductor Fittings

Straight and Parallel Connectors, Cable Taps, Lugs, Tees, Service Connectors, Grounding Clamps, Elbows, etc. etc.
PENN-UNION ELECTRIC CORP.
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WHEN YOU THINK OF OUTDOOR METERING
THINK OF KEES
● Meter boxes instrument transformer cabinets. Catalog 18 shows sizes for every application.
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DOSSERT CONNECTORS

A one piece heavy duty cable tap. No loose pieces. Cables readily inserted from end or sides as illustrated. For complete listing of Power connectors send for Catalog 45.
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LEAD AND ALUMINUM PAINT
Spot or Full Coat for Galvanized Structures.
It sticks, it blends.
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Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled change in industrial personnel.

McGraw-Hill Mailing Lists cover most major industries. They are compiled from exclusive sources, and are based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff. All names are guaranteed accurate within 2%.

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intendent for a number of years. In 1937 he was appointed chief electrical engineer of both the Westchester and Yonkers companies, the position he held until he was made chief engineer in 1942. Mr. Cornell moved to Sanford, Fla., from Scarsdale, N. Y., on his retirement.

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E. A. Lewis

E. A. Lewis, vice-president and general manager of the Ohio Power Co., Canton, whose death was announced in the October 19 issue of ELECTRICAL WORLD, page 6, entered the utility in-

dustry with the Public Service Co. of Northern Illinois in 1903. He remained in the employ of this company until 1908, when he became identified with the electrical department of the Lincoln Park Commission of Chicago.

In 1911 he removed to Atlantic City, N. J., and took charge of the Missouri Avenue power house of the Atlantic City Electric Co. an American Gas & Electric property. He was serving as superintendent at the end of 1919, when he was transferred to the Scranton (Pa.) properties of the American Gas & Electric system in the same capacity. Returning to Atlantic City as assistant general manager, Mr. Lewis was made vice-president and general manager in 1931.

It was in 1941 that Mr. Lewis was appointed vice-president and general manager of the Indiana & Michigan Electric Co., three years later going to Canton in the same capacity.

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▶ FERRIS LEROY FRANCISCO, senior partner in the engineering and architectural firm of Francisco & Jacobus, New York, died on October 11 in Post-Graduate Hospital at the age of 66. Mr. Francisco established his own firm in 1912. He was a member of the American Institute of Electrical Engineers.

THESE 6 LITTLE POINTS will help you get Longer Pole Life

• These six little ½ in. x ¼ in. steel points on the Multipoint Cant Hook take a sure, firm grip on any pole from the smallest up to the big 22-inch ones. They make no deep stab through the pole's creosote surface treatment to let in moisture and air which encourage rot. With automatic release for quick action, the SturdE Multipoint Cant Hook is easy to use; crews like the steady, firm grip it takes and *holds.*

This SturdE Multipoint Cant Hook is being specified by more and more utilities because it is a real time and money saver. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio, Makers of True Temper Products.

STURDETOOLS
a TRUE TEMPER PRODUCT

Exclusive SturdE feature . . . six little steel points grip pole firmly but don't pierce creosoted surface. Points are easily renewable. Made in three sizes, small, medium, large, to handle all poles up to 22 inch. Hickory or maple handles. Automatic release makes for ease and speed in use.

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Wilson Tells 'What's Ahead for Business,' Problems of Industry and G.E. Identical

"There is nothing ahead for business except what it will earn by its performance, a united performance, by an inspired management, by an informed and cooperative labor, and by a government that will once more be the servant of all the people."

This was the answer of Charles E. Wilson, president of General Electric Co., to the question, "What's Ahead for Business?", a speech delivered recently before the Chicago Economic Club.

Using his own company as an example, Mr. Wilson explained the difficulties which all manufacturers face today, material shortages, government controls, labor problems, and their constant struggle to bring the nation's economy back to normalcy by raising production to heights far above those of pre-war days.

Metal Shortages a Handicap

Among the material shortages to which he alluded was that of copper. With a domestic production of only 65,000 tons a month to meet requirements of 100,000 tons, the government retains for itself a monopoly on the importation of copper from foreign sources, then fails to make up industry's deficit, mainly because the domestic ceiling on copper is 14⅜ cents a pound while the world price is 17 cents. The situation is similar with regard to lead and zinc. Several grades of steel greatly needed for electric appliances are disappearing from the market because the steel companies are discontinuing their manufacture until ceilings are raised to permit production with profit.

Constantly increasing demands for higher wages by labor leaders at the same time accompanied by less efficient production on the part of the workers, Mr. Wilson pointed out, are leading to higher costs which will be followed in turn by higher prices and a decreasing market for all products, with economic ruin the final conclusion. He expressed the belief that management itself is in some part responsible for not making clear, in advance of wage demands, that higher wages must necessarily be reflected in higher prices, because the money for wages must come from some place.

"In the last 13 months," the General Electric president said, "our plants have increased from 34 to 112, scattered across the country. The large majority of the new ones employ fewer people per plant, from 30 to 1,500, and they are producing everything from electric blankets to small industrial turbines."

As part of this reconversion picture, which is doing so much to aid both the nation and the worker, Mr. Wilson revealed the production trends of his company and the goals for which it is striving; many of these would have been reached if it had not been for labor troubles, material shortages, and government controls.

"In fractional horsepower motors, we now have a production rate of 150 percent of pre-war volume, as against a goal of 220 percent. In fluorescent ballasts, important for lighting new construction, we are producing 170 percent of the pre-war volume, but our goal is 370 percent. Electric meters, vital to new housing, are being made at 127 percent of pre-war volume, with a goal of 145 percent. Distribution transformers, upon which depends new rural electrification, are at 154 percent, and ultimately will be 230 percent of pre-war.

"In household appliances our reconversion and expansion are about 80 to 90 percent complete. We are making only about 75 percent of our pre-war volume in refrigerators, with a goal of 150 percent, and this is an outstanding example of the crippling effects of the sheet steel shortage. Our current rate in washing machines is 165 percent of pre-war, but the goal is 240 percent; and we are making 105 percent as many irons as pre-war, with a goal of 150 percent."

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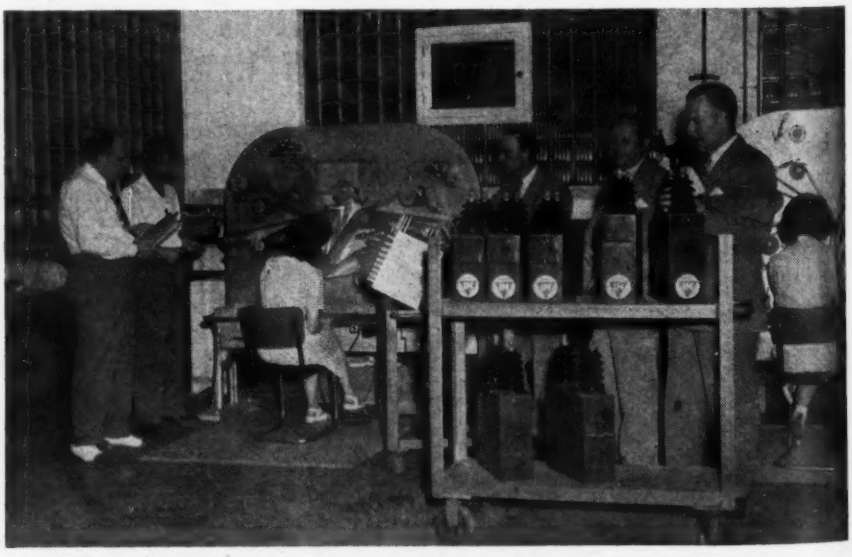
Cleaner Sales Near Peak

Factory sales of household vacuum cleaners totaled 223,039 in September, substantially higher than the pre-war



CHECKING UP—Officials of the Line Material Co. inspect production at the company's new capacitor plant at South Milwaukee, Wis. Gathered in the corner of the modern, air-conditioned, humidity-controlled pack winding department are C. J. Lemont, vice-president in charge of production; A. J. Hoynacke, plant engineer; A. R. Waehner, capacitor engineer; A. G. Steinmayer, vice-president in charge of research and engineering; and D. H. Swanson, vice-president in charge of sales

record, but below the record high of August when 234,148 units were produced, the Vacuum Cleaner Manufacturers Association has reported. The figure compared with 209,108 in September, 1941, and the pre-war high of March, 1941, when 217,906 cleaners were made.

•

Need for Sales Promotion Theme of CEMA Meeting

That an intensive industry-sponsored sales promotion and public educational campaign is fundamental to the future of the electrical manufacturing industry was the basic theme of the Canadian Electrical Manufacturers Association annual meeting at Niagara Falls, Ont., on October 10 and 11.

R. L. White, president of the National Electrical Manufacturers Association, (U.S.A.) spoke on needs of promotion and the technique as practiced in the United States; and R. G. Cavell, vice-president of Phillips Electrical Works, Ltd., and Automatic Electric (Canada) Limited, spoke on the needs of clear thinking and public education.

"Business cannot grow in chaos," Cavell began. "Under unstable conditions business is the first thing to shrink and die, and with it dries up the life blood of the people.

"Our way of life is based on free enterprise and is absolutely dependent upon vast production. We have everything except the one thing most vital. We must bring into being a new concept of the relationship of capital, management, and labor. Only genuine cooperation will produce the volume of goods and services our system must have to keep it healthy.

"If we fail as leaders in this vital field, the problem will be taken out of our hands. We shall inevitably get more governmental regulation, and we shall encourage the growth of communistically inspired doctrines which responsible labor leaders do not want any more than we do."

Mr. White spoke of the need, scope, and technique of association sales promotion as practised in the United States. "Generally speaking," he said, "use of electricity as a labor saver on the farm and in the home has not developed in Canada as much as it has in the United States. Canadian manufacturers, therefore, have a considerable educational job to do on some type of home appliances and on farm electrification programs. Your association is doing a real job in adequate wiring which is the foundation for all development programs."

He spoke at length on the "bottled gas" competition in the United States. Here, he added, over two million customers are utilizing it for cooking and

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15,000 dealers are, in a sense, private utilities competing with the local electric utility. NEMA has a new program which will be helpful in convincing present and new customers to "Go All-Electric," he concluded.

•

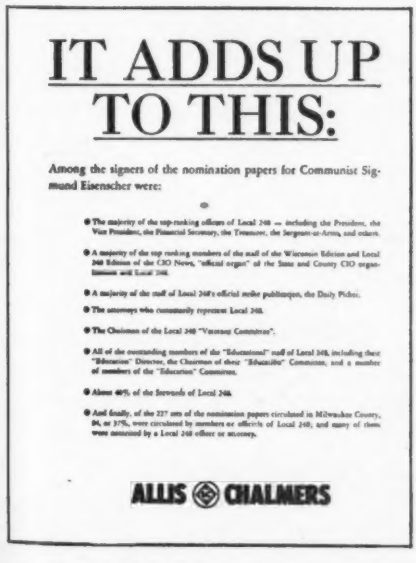
Allis-Chalmers Co. Union Members Endorse "Red"

Penetration of Communists and "fellow travelers" into Local 248, U.A.W.-C.I.O., on strike at the West Allis Works of the Allis-Chalmers Mfg. Co., is charged in the booklet, "Principle Represented: Communist—Would You Sign Your Name Under This?" published recently by the company. The booklet, which was sent to 11,500 Allis-Chalmers employees, reproduces photostatic copies of nomination papers endorsing Sigmund Eisenscher of Milwaukee as the Communist candidate for governor of Wisconsin.

Among those whose signatures are discernible are the top-ranking leaders of Local 248 and include Robert Buse, president; Joseph Dombek, vice-president; Linus Lindberg, treasurer; John Kaslow, sergeant at arms, and Alfred Ladwig, financial secretary.

Also included are top-ranking members of the Wisconsin Edition and Local 248 Edition of the *C.I.O. News* staff; members of the *Daily Picket* staff, the union's official strike publication; attorneys who customarily represent the local; the chairman of the union's Veterans Committee, members of the union's 'educational' staff and approximately 40 percent of the shop stewards.

The bulletin states that of the 227 sets of nomination papers circulated in Milwaukee County, 84, or 37 percent, were circulated by members or officials of Local 248; and many of these were notarized by a union officer or attorney.



THE EVIDENCE—Summary of the bulletin's content as presented on the last page. Previous pages contain photostatic evidence of the nomination paper signers and their connection with communistic activities and the West Allis Union, Local 248, now on strike at Allis Chalmers Mfg. Co.

•

Value of Better Sources of Light Depends on Usage

Many of the dollars spent on research and engineering to produce a more efficient electric light source are being tossed aside by inefficient methods of utilizing that output, Samuel G. Hibben, director of applied lighting, Westinghouse Electric Corp., stated at the recent I. E. S. meeting in New York. Better selection and placement of lighting fixtures in stores, offices, factories, schools and homes are needed to correct this situation.

Development of new light sources and improvement of old ones have outpaced the control and reflection of light after it has been produced. This "blind spot" between the outer wall of the lamp bulb and the inner wall of the eyeball needs to be filled in.

In discussing tomorrow's light sources, Mr. Hibben pointed out that the ultimate goal of the fluorescent lamp is about double that of today's tube. Research engineers are now concentrating on the selection of purer phosphors and the improvement of electrodes at the tube ends.

Work is also underway to add more pink tones to "warm up" the bluish white color of the mercury vapor light by two color techniques. The first of these is by utilizing a pink-producing phosphor coating on the inside of the outer bulb and the second, by using a fluorescent glass in the bulb. Another line of research in mercury vapor lamps is the development of an improved bulb which will resist higher operating temperatures than the present fused quartz inner bulb.

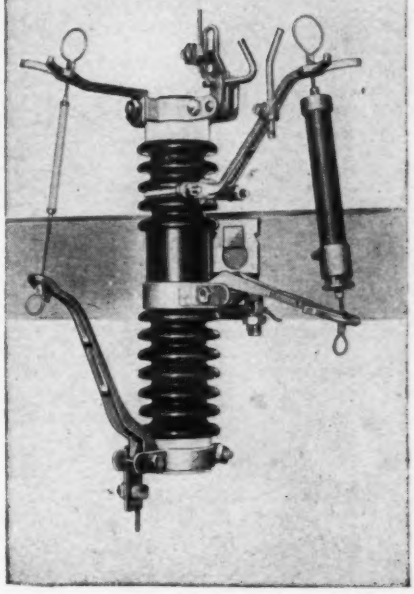
•

Bailey Meter Co. Adds Eighty Field Engineers

Because of substantial increases in new construction and modernization of central station, industrial, and marine power plants, Bailey Meter Co., Cleveland, Ohio, has announced additions to its staff of 80 field engineers, located in 30 industrial areas throughout the United States and Canada.

These new men have completed an extensive training course at the company's factory in measurement, combustion, and automatic control especially as it applies to power plants.

GAP and FUSE PROTECTION for RURAL LINES



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Write for Bulletins 101-A and 105

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Now in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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Recent Rate Changes

READING (OHIO) MUNICIPAL LIGHT AND POWER PLANT has put into effect an increase of ½ cent per kilowatt-hour for electricity. Mayor Charles Gertz stated that the step-up was prompted by increased costs of coal, labor and materials. Residential rates increased are: first 30 kw.-hr., from 4½ to 5 cents; next 50 kw.-hr., from 3½ to 4 cents; next 50 kw.-hr., from 3 to 3½ cents; over 150 kw.-hr. from 2 to 2½ cents. Increases in electric rates for commercial, power and wholesale use will also be made.

MANITOBA POWER COMMISSION, Winnipeg, Manitoba, has announced that effective with the November billing for energy consumed in October, the first block of 100 kw.-hr. in commercial rates will be reduced from 7 cents to 6 cents per kilowatt-hour. There will be no change in the second block of 200 kw.-hr. at 4 cents per kilowatt-hour and all additional energy will remain at 2 cents per kilowatt-hour. This reduction will be effective over the entire system except that the second block rate in the cities of Brandon and Portage la Prairie will be 3 cents per kilowatt-hour.

LOS ANGELES BOARD OF WATER AND POWER COMMISSIONERS has adopted revised rate schedules that will save $1,566,000 annually for users of electricity in the city. The revised rates were proposed by Charles P. Garman, chief electrical engineer, Samuel B. Morris, general manager and chief engineer. Los Angeles city council must adopt an enabling ordinance to make the new schedules effective. Residential, commercial and industrial consumers will share in the savings, which average 3.29 percent for homes, 6.08 percent for the commercial general lighting group, and 1.44 percent for industries and other power users. Inyp-Mono area customers will receive proportionate reductions Residential savings will amount to $526,000 a year. All domestic service customers in the Los Angeles area will be affected except approximately 1 percent, who use only 12 to 22 kw.-hr. monthly. Their bills will be increased slightly due to a change in billing which eliminates a present minimum charge of 55 cents for 13 kw.-hr. at 4.23 cents per kw.-hr. and substitutes a monthly customer charge of 30 cents, plus cost of energy at a 2.8-cent rate for the first 45 kw.-hr. Charges for energy above this amount are at decreasing rates. A change in the lighting circuit base from the present eight to ten circuits or less will permit the average home to have more lighting circuits in accordance with modern wiring trends, without additional rate charges. Commercial customers will get $898,000 of the annual reduction, while industries using general power service will save an additional $133,000.

KENTUCKY & WEST VIRGINIA POWER CO., Ashland, Ky., has been authorized to establish a straight kilowatt-hour rate of $1.20 per month per kva. on power it sells to 22 municipally and privately owned waterworks in Kentucky. The new rate, requested by the company and approved by the Kentucky Public Service Commission, will save the waterworks a total of $9,700 a year. It becomes effective November 1.

PIONEER ELECTRIC CO-OPERATIVE, which provides electric energy for the rural areas of Butler, Crenshaw, Lowndes and Dallas counties, has announced a reduction in domestic, commercial and water heater rates. Savings range from 5 cents to 2 cents per kilowatt-hour.

SEARCHLIGHT SECTION

(Classified Advertising)

Continued on pages 135-137

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P-372, Electrical World
330 West 42nd St., New York 18, N. Y.

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ONE OR TWO graduate electrical engineers, between 30 and 45 years old, having good experience with electric utility operating companies wanted by consulting firm doing work for foreign utility companies. Some foreign travel probable. Knowledge of Spanish or Portugese very desirable but not a necessity. P-364, Electrical World, 330 W. 42nd St., New York 18, N. Y.

A CONTRACTING FIRM in India requires Transmission Line Engineers experienced in Design and Erection of Transmission Lines up to 132 Kv. Reply giving full particulars and salary expected. P-374, Electrical World, 68 Post Street, San Francisco 4, Cal.

METER and relay technician, thoroughly competent to repair all types of protective relays, watthour and demand meters and laboratory equipment. Address replies to P. O. Box 257, Florence, Alabama, stating experience, age, references, salary desired and when available.

ELECTRICAL ENGINEER graduate for work in chemical plant, northern West Virginia. 90% design, 10% field. Subsidiary of large, well-established corporation. P-377, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

MINE ELECTRICIAN wanted for Nicaragua experienced in line work, motor winding, and switchboard. Must report single status first few months. Transportation, board and accommodation furnished by company. Salary open. Apply giving details, age, experience, salary desired. P-378, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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(Continued on the opposite page)